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ABSTRACT

This book, which is based on the papers presented by the various countries attending an international conference on technology and adult learning, contains 16 papers examining the use of technology in adult learning programs in the context of major institutional and economic change. The following papers are included: "A View from Philadelphia: Fifty Years On" (Stephen McNair) with a French version, "Philadelphie: en avance de 50 ans"; "Australia--Learning Technologies in the Tourist Industry" (Ralph Leonard); "Canada--Technology in Adult Second Language Training" (Bernart Hart, Katherine Peart); "Denmark--The Country of the Classroom" (Lilla Voss); "France--Tele-langues Distance Learning for Language Teachers: A Distance-Training Programme for Language Teachers Using Authentic Audio-visual Materials"; "Germany--Multimedia Systems in Corporate Training" (Peter Schenkel); "Italy--An 'Inform-active' Learning Environment" (Graziella Tonfoni); "Japan--Technology and Higher Education" (Akemi Kawafuchi); "Korea--Multimedia in Company Training" (Beyong-Gil Sohn, Young-Sun Yang); "Netherlands--Networks and Materials" (P. A. Kirschner et al.); "New Zealand--Technology and Deregulation" (Tom Prebble); "Norway--An Electronic College" (Morten Flate Paulsen, Torstein Rekkedal); "Spain--Education in Rural Communities" (Elena Veiguela Martinez, Carlos San Jose Villacorta); "Switzerland--Learning Technologies in Companies" (Alan McCluske); and "United Kingdom--Technology for Adult Learning" (Eddie Brittain). (MN)

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ADULT LEARNING AND TECHNOLOGY IN OECD COUNTRIES

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Adult Learning and Technology in OECD Countries

Proceedings of a Round Table held in Philadelphia, United States on 14-16 February 1996

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FOREWORD

The economic and social changes under way in all OECD countries are generating an ever-increasing demand for adult learning in higher education and vocational education institutions, enterprises, adult learning and literacy community centres, and in the home. Many specialists and policy makers now recognise the diversity of adult learning requirements. Furthermore, adults live and work in contexts that are not easily served by conventional educational institutions.

The challenge of ensuring access to quality learning at reasonable cost cannot be met by using only traditional teaching methods (for further information, see *Information Technology and the Future of Post-secondary Education*, OECD, 1996, and *Adult Learning in a New Technological Era*, OECD, 1996). Information and communication technologies, including both new developments in multimedia facilities and their transmission through information highways as well as "older" technologies of radio, television and telephone, offer unprecedented opportunities for adult learning. Such technologies will increasingly allow all adults the opportunity to pursue learning in ways that suit their own circumstances.

As part of the Centre for Educational Research and Innovation (CERI) work on new delivery systems and changing demands for education, and as part of an on-going series of roundtables organised with the U.S. National Center on Adult Literacy (NCAL), University of Pennsylvania, an international roundtable of national representatives of OECD countries was held in Philadelphia in February 1996. It discussed implications for policy, practice and research of the use of technology to facilitate adult learning in the context of objectives for lifelong learning. The discussion was based upon case studies prepared in 15 OECD countries on significant developments of technology-based learning facilities for adults in various sites.

This joint CERI/NCAL publication is the fourth roundtable report. It begins by summarising the main points that emerged from the discussion and then presents the case studies. As in the past, the success of the co-operation between the CERI and NCAL is due particularly to NCAL Director, Professor Daniel Wagner, and his team.

This report is published on the responsibility of the Secretary-General of the OECD.

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INTRODUCTION
TECHNOLOGY AND LIFELONG LEARNING

This book is based on the papers presented by the various countries attending the OECD/NCAL conference held in Philadelphia, United States, in February 1996. The papers are very different in style and format, reflecting both national differences and the different roles and expertise of those who contributed. Since no attempt has been made to force them into a common format, this introduction is intended to help readers by providing pointers to what issues are addressed where.

Almost all case studies contain some introduction to the particular circumstances of the country and its approach to technology in adult learning, and all then present one or more case studies, either of the application of technology to a particular learning need, or to the development of an institution. Some also include more theoretical accounts of issues and approaches, and some include proposals or recommendations for the future.

The themes

There are common themes addressed by a number of papers. The list below is not comprehensive, but it seeks to identify those chapters which have taken a particular interest in each theme.

- *Access to learning* -- Australia, Canada, Norway, Spain, United Kingdom
- *Broadcasting* -- Canada, Japan, New Zealand, Norway
- *CD-ROM* -- Germany, Korea, New Zealand, Switzerland
- *Communication networks* -- Denmark, Germany, Japan, Netherlands, Norway, United Kingdom
- *Computer Based Learning* -- Germany
- *Copyright* -- Canada
- *Culture* -- Canada, Korea
- *Email* -- New Zealand, Norway, United Kingdom
- *Evaluation (of programmes)* -- Canada, Germany, Japan, New Zealand, Norway, Spain, Switzerland, United Kindgom
- *Funding* -- Denmark, Germany, New Zealand, Norway, United Kingdom

- *Gender* -- Canada
- *Institutional organisation and futures* -- Denmark, Japan, Netherlands, New Zealand, United Kingdom
- *Instructional design* -- Italy, Korea, Netherlands
- *Interactivity* -- Australia, Denmark, Italy, Japan, Netherlands, United Kingdom
- *Internet/Worldwide Web* -- Denmark, Netherlands, New Zealand, Norway, Switzerland, United Kingdom
- *Learning* -- Denmark, France, Italy, Netherlands, Switzerland
- *Learning organisations* -- Germany
- *Lifelong learning* -- Italy, Japan, Korea
- *Multimedia* -- Germany, Netherlands, New Zealand
- *National reports/reviews* -- Denmark, United Kindgom
- *Open lectures* -- Japan
- *Professional updating* -- Japan, Germany
- *Rural isolation* -- Australia, Canada, Denmark, Spain
- *Satellite* -- Australia, France, Japan, New Zealand, Norway, Spain, United Kingdom
- *Language learning* -- Canada, France
- *Teaching staff* -- France, Norway, Spain, Switzerland, United Kindgom
- *Television* -- Canada, France, New Zealand
- *Testing (of students)* -- Australia, Germany, Netherlands, Norway, Spain, United Kingdom
- *Workbased/corporate learning* -- Australia, Germany, Korea
- *Videoconferencing* was addressed in almost every paper.

The papers

There are a number of common strands to all the papers, all are discussing technology in adult learning in the context of major institutional and economic change. Many countries have undertaken major reviews of their policies.

A view from Philadelphia: 50 years on

This paper was written by the rapporteur general for the Philadelphia conference. It identifies the broad themes of the discussion and identifies some common issues for the future (the French translation of this paper is also included).

Australia

The Australian paper describes the context of a country where attitudes to new technology are unusually positive. It then presents three case studies of the application of technology to the training of staff in the tourist industry, using video conferencing, satellite, and data networks.

Canada

The Canadian paper outlines the state of development of various technologies in adult learning. It presents three case studies of applications of technology to the teaching of English as a second language, using closed captioning of broadcast television, distance learning using print, telephone and tape recorders, and networked CBL. It concludes with a discussion of implications for practice, research and policy.

Denmark

Although, in Denmark, with a strong cultural commitment to the traditional classroom, and relatively few geographically remote areas, technology is seen as a potentially enriching option, not as a major transforming force, change has been happening. The paper reports on the Ministry of Education report of 1993 and the follow up to that. The two case studies concern delivery of education to a remote island community (Bornholm) through partnership between institutions, and an in-service training programme for lecturers in teacher training colleges.

France

The French study concentrates on a single project ("Télé-Langues"), which sought to train teachers in the use of authentic television material as a basis for foreign language teaching. It discusses the teaching and learning processes and the role of motivation and technical support.

Germany

The German paper is concerned with multimedia technology in corporate training. It reviews some of the academic literature on the issues, and then presents a detailed case study of their application in a Computer Based Training programme of Robert Bosch GmbH. A significant feature is the decision to provide workers with multimedia computers and software for home use. The paper concludes with a set of general conclusions and recommendations.

Italy

The Italian paper is alone in being exclusively concerned with the processes of learning itself. It argues that technology is being used without adequate reflection on learning processes, and that, to prepare people for lifelong learning, we need strategies which enable individuals to acquire skills of reflection on learning itself, simultaneously with the acquisition of knowledge. It describes an approach ("Inform-active learning"), developed at the University of Bologna, to achieve this.

Japan

The Japanese paper includes a brief overview of changes in education and the labour market in Japan, before offering case studies of four institutions using broadcast or satellite technologies for general higher education (the University of the Air), for professional updating (Hokkaido Institute of Information Technology, and Refresher Education), and for public information (Open Lecture programmes).

Korea

The Korean paper is a single case study of the use of multimedia CD-ROM by Samsung in the training of businessmen for work in China. It describes the history and implementation of the project and offers some evaluative comments.

Netherlands

The paper from the Netherlands begins with a national overview. It then develops a conceptual framework for analysing the use of technology in education, and describes a number of initiatives. The bulk of the paper is devoted to two large case studies. The first is BVEnet, which is being created as a national "logical" network, an infrastructure for a wide range of educational development. The second is ILCE, a project which is developing and disseminating learning materials.

New Zealand

The New Zealand paper begins with an account of government approach to higher education, in the context of a government strongly committed to deregulation and privatisation. It then describes the experience of a single dual mode institution (Massey University) in experimenting with a number of technologies, including television, teleconferencing, computer based communication and multimedia. It concludes with a view of the possible future.

Norway

The Norwegian paper includes a substantial section on the national context, of a country with strong traditions of distance learning. It then provides a substantial study of a single large non-governmental institution (the NKI College) through two phases of its development since 1987. It includes some detailed evaluative material on the comparative performance of students using new technologies and those using traditional ones.

Spain

The Spanish paper describes an experimental programme designed to overcome the problems of rural isolation through establishing local technology based classrooms in small towns in the provinces of Castile and Leon. It offers a relatively low cost model, and describes the roles and functions of the various partners.

Switzerland

The Swiss paper presents an extended review of the corporate use of learning technology in Switzerland. It is based on a survey and interviews with 30 major companies, examining both practical and theoretical issues and concludes with short case studies of learning technology in 10 specific companies.

United Kingdom

The British paper describes the national scene, including a range of government initiatives in technology in education. It then presents four case studies, the application of technology to the University education of professional pharmacists, the use of technology across a whole institution (the TILT project in Glasgow University) and the use of multimedia, video conferencing and cable technology in two Colleges of Further Education (Halton and Blackburn).

A VIEW FROM PHILADELPHIA: 50 YEARS ON

by
Stephen McNair
Conference Rapporteur
National Institute of Adult Continuing Education, England and Wales

Introduction

New technologies, like revolutions, are always mixed blessings. They make it possible to do things faster, more easily, and more efficiently. They make it possible to do new things which we would never have imagined, and make it difficult to do some old things in old ways, even when we want to do so. Like gifts in Greek mythology, every benefit has its price. So it is with the application of information technologies to learning.

Because the impact of information technologies on society and education is great policy makers have to try to understand and anticipate change. Failure to do so may lead to economic disaster, and unregulated change may lead to a deepening of inequality and social division. However, because the technologies are unfamiliar and unpredictable, we will often be wrong in our predictions.

Alongside developments in technologies, policy makers are also becoming interested in lifelong learning. For many years the OECD has been arguing for greater attention to the issue, and the decision of the European Union to designate 1996 as the "Year of Lifelong Learning" is only one sign of a rapid rise in its political priority in most developed countries. At last governments are beginning to recognise that, in a world of accelerating change, an exclusive focus on initial education, which can only replace the skills of the workforce at a rate of 2-3 per cent a year, makes no sense.

The two issues are closely linked, since information technologies help to create the need for lifelong learning, and also offer help in addressing that need. It was this interconnection which led the OECD, in conjunction with the United States National Council for Adult Literacy to convene a "Roundtable" in Philadelphia in the spring of 1996. As it happened, the event coincided with the 50th anniversary of the launch, in Philadelphia, of the world's first electronic digital computer (ENIAC) providing an opportunity to reflect on how far we have come in a short time.

The roundtable brought together representatives from government and education from 20 developed countries to discuss examples of the use of technology in adult learning, and to see whether common patterns and directions could be discerned. This book is based on the papers presented by 14 delegates, and we try here to identify some of the findings.

The key messages

This overview comments on eight key messages from the discussions. They are that:

- the most difficult and expensive issues are human, not technical;
- the cultural diversity of OECD states will have important implications for their use of technologies;
- lifelong learning is more than "schooling for adults";
- education and training systems will need to shift focus from teaching to learning;
- communications technologies will bring fundamental changes in the roles of staff;
- communications technologies will bring fundamental changes in the nature of institutions (including educational institutions);
- the most appropriate technology is not always the "leading edge" one;
- the technologies are unlikely to reduce social or educational inequality without intervention in the market.

Finally it identifies a number of issues or conclusions which emerged from the discussion, each of which could properly be the subject of further discussion and research.

The impact of the technologies

Everyone in Philadelphia recognised that technologies which determine who has access to information and knowledge, and how people communicate with each other, cannot be marginal to political, economic or social debate. One speaker pointed out that while the industrial revolution created a division between the spheres of working and personal life, the information technology (IT) revolution may be reintegrating them, moving some of the most fundamental boundaries which distinguish our cultures. Responding to the United Kingdom presentation, Sylvia Ostry argued that the IT revolution is qualitatively different from its predecessors. Unlike the agrarian and industrial revolutions, the impact of the information revolution is on the service sector, and as much on public as private sector activity. We know little, she argued, about how innovation takes place in the public sector, and it is in the public sector that national cultures exert their greatest influence. The information revolution affects who we think we are, not only how we live our lives.

By redistributing information and knowledge, these technologies will change structures of power and authority within organisations (including educational institutions) and the way they work. They also force us to rethink our education systems, giving more attention to adult learning, reshaping how we prepare young people for adult life, stressing the autonomy of the learner, shifting the focus of systems and processes from teaching to learning, and the balance between public and private sector provision. More fundamentally, by redefining the ways in which people get access to information and knowledge, they raise quite new questions about how knowledge is created, and who owns it.

The speed of change in the technologies themselves, adds a further layer of complexity, by dissolving many "traditional" distinctions, on one hand between such fields as "education" and "entertainment", and on the other between familiar categories like "information technology", "educational technology", "telecommunications" and "computing". In this report we have chosen merely to use the term "technologies" to embrace this wide spectrum.

A human issue

Perhaps the most important message from Philadelphia is that the critical issues are human, not technical. Discussion returned repeatedly to how people learn to use the technologies, and why they resist them. Several presenters reminded us that most of the cost (one speaker argued over 90 per cent) of applying technology to learning lies in enabling people to manage and use it, in awareness raising, training and the restructuring of organisations, not in the acquisition of hardware and software. A number of speakers pointed out that what is perceived as irrational resistance to change is often an entirely reasonable reaction to inadequate consultation, poor implementation, lack of training and information and support.

The human dimension makes the attempt to learn from each other across national boundaries both exciting and challenging. Human beings live in communities, of location, language, family, and nation, which are bound together at the deepest level by culture and values. Our differences are not merely that we use different words for the same thing, our languages embody different notions of what it is to be human, and of what are proper relationships between people (including between teachers and learners). A commentator on cultural difference observed two factory production lines, one in Japan and one in the United States. Both appeared identical and at the end of each stood an inspector, watching the products come off the line, and looking for any which did not conform to the specified standard. However, when questioned, the United States inspector described his task as identifying "faults", so that the person responsible could be identified and disciplined, while the Japanese inspector said that he was looking for opportunities for learning, and for differences which might make improved or new products. Beneath the apparently identical process lay profoundly different value systems, notions about purpose, and about human relationships. When we change who can communicate with whom, and by what means, we are moving the roots of our cultures.

Cultural diversity

Although they have much in common economically, the OECD Member states are very diverse, culturally, socially and geographically. This gives a great richness to the Organisation's debates about lifelong learning: Spain, Canada and Denmark share a concern to bring education to physically isolated communities, but there are no simple equations between the problems of Northern Canada, the Danish islands, and rural Castile. Nor do the national cultures share attitudes to technology or learning. Australians typically embrace technology with enthusiasm: from schooling by radio in the 1950s to the video conference classrooms of South Australia in the 1990s they have experienced technology as a means of overcoming geographical isolation by creating a "virtual community". The Danes, on the other hand, have a strong tradition of locally based adult education, with very high rates of participation in face to face classes. For them education is a social activity, and resistance to the technology may reflect a proper valuing of the communal rather than an obstructive resistance to change. The Danish view that "learning together is fun", is supported, in a rather different way, by the Japanese, with their concern to preserve forms of education whose focus is social rather than purely economic. The Swiss paper reminds us that, even within a small country, attitudes to the technology can vary between language and cultural groups.

Lifelong learning

Schooling prepares people for life in the adult community: lifelong learning is a part of it. School systems can assume a limited time span of responsibility: their learners are delivered, willingly or otherwise, to the door, and the school's task ends a few years later when they leave. Lifelong learning, on the other hand, begins with raising awareness, motivating individuals and convincing them that learning is a means of addressing their individual problems and needs. It involves complex processes of guidance and negotiation to match the learning to the needs of individuals and groups. And the learners never "leave", though they may move backwards and forwards between providers, and do much of their learning outside any formal institution.

The role of the technologies in adult learning is correspondingly complex. Some, like broadcast television, may make a special contribution to awareness raising or motivating, while others may be particularly useful in assessing achievement for people who have been learning in a range of locations and ways. Others may be helpful in assisting learners to make wise choices of learning routes or planning future careers. A lifelong perspective also reminds us that much (perhaps most) adult learning has always taken place outside the walls of the formal educational institution. If we want to develop a learning society we should be interested in how the technologies can support this learning, as well as the more structured forms.

In a knowledge based economy and society learning is not something "added on" to stable social and economic processes: it changes those processes, and is one of the ways in which a society reflects on and redefines itself. The Korean paper drew attention to the "social constructivist" role of lifelong learning: it is one of the ways in which we reshape our societies, whether the state chooses to intervene actively, as in several Asian examples, or to allow the market to operate with minimal constraint as in New Zealand.

Lifelong learning also changes the relationship between the content and form of learning. If we are to continue learning throughout our lives we need to become better learners, and educational systems will spend more time helping us to understand and develop our learning skills, and less to transmitting "content". Paul Kirschner from the Netherlands argued that only 50 per cent of their Open University's material is "content" in the traditional sense. The rest reflects on that material, explaining its purposes, suggesting ways of handling, organising and reflecting on it, illustrating issues, testing learning and relating it to the outside world. At a more theoretical level, Graziella Tonfoni from Italy argued for giving more attention to reflection on the learning process. By "slowing down" the acquisition of knowledge, and adopting more active learning methods, we develop more efficient skills of learning itself.

A world of accelerating change and lifelong learning also changes the balance between theory and application, and the authority of the teacher. In Europe since the 17th century the process of knowledge creation and transmission has been seen as linear. Put simply, researchers observe the real world, define legitimate knowledge and formulate theory, which they then transmit to students. The knowledge is created and owned by this small community of "experts". This monopoly of validated knowledge brings high status to experts; research and theory are more highly valued than learning and practice; and abstraction is more highly valued than solutions to problems.

These relations are transformed in a world where knowledge is expanding rapidly, and is much more accessible. Far more people are involved in the processes of knowledge creation and transmission: knowledge becomes more accessible but less manageable, while theory is more frequently tested against practical problems. This will present a challenge to all cultures, but especially to those which have traditionally given a high status to theoretical knowledge, and those which have drawn sharp dividing lines between vocational and academic knowledge, since skills and knowledge will increasingly flow across such boundaries.

Linked to this is change in the relationship between the individual and the organisation. We are seeing the growth of "learning organisations", not merely as firms where all the employees enrol on courses (though that would be progress), but as organisations built around the need to constantly learn and adapt. As Kaisa Kautto-Koivula from Finland argued in her response to the German presentation, the learning organisation "learns" in the same way as an individual, and can suffer the same kinds of problems (like inefficient memory) in doing so. At the same time, learning and work are practically related in new ways. The example of home based training in Bosch, presented by Peter Schenkel, illustrates a shift of work related learning from the employers time and place, to the private space of the employee: like the gifts of Greek mythology, it brings benefits whose true meaning is only clear after the event.

From teaching to learning

Lifelong learning calls for a shift of educational attention from teaching to learning: from what teachers think should be taught to the problems which learners need to solve. What is a "coherent" programme of learning or qualification becomes a question of what makes sense to the learner, in the light of his or her previous learning and personal circumstances, not what a professor has defined as an intellectual domain.

The development of individual autonomy in learners also becomes critical. The Australian paper notes that students in remote video conferencing classrooms were more active, interrupting and challenging the teacher much more than those who were in the room with her. Like the Danish study groups, they were seeking to take control of their own learning. We need to foster such independence, since lifelong learning cannot be based on the continuous presence of teachers. It will only work if everyone is a confident and competent learner, able to recognise how learning will enable them to tackle their particular problems, and to make wise choices about how to do it.

As the Swiss and German papers point out, the technologies make it possible for us to recognise more complex differences between individuals. We can recognise more forms of knowledge and of intelligence and no longer need to operate as if all learners shared a common learning style. However, we have yet to understand the pedagogical implications of many of the tools now available to us, and the pedagogy underpinning much technology based learning remains quite unsophisticated.

A key issue will be the development of information management skills, in both individuals and machines. Learning how to find one's way around a new field of knowledge or an unfamiliar library can be a daunting task, but when each of us has access to all the world's libraries it will become impossible without much more sophisticated skills of navigation, selection and analysis. Similarly, electronic mail frees us from the restraints of place and time, and enables the human race to generate far more messages than it can read. In education it makes it possible for individual learners to place quite unmanageable pressures on teachers, and those developing email based learning systems will need to find strategies for dealing with this.

Changing roles of staff

Though they may meet learners face to face less often, and in different ways, teachers will remain central to most adult learning, and several case studies note how the introduction of new technology forces teachers to rethink how they plan and organise their work, and how they understand their subjects. Since most teachers are interested in their subjects and how they are transmitted, many welcome the challenge to reshape their own understanding, sometimes working in teams with other colleagues. But such processes take time, which is usually scarce, and those accustomed to a "free flowing" approach to teaching, adapting each week's lessons to last week's progress, and linking to topical issues will find the much longer time scales imposed by some technologies difficult.

We are accustomed to teachers knowing answers, and admitting ignorance is a particular problem for teachers used to an unquestioned authority deriving from their control of the knowledge base and mastery of its delivery. When delegates visited the Department of Computer Science at the University of Pennsylvania, it was pointed out that the driving force of technological change is not in education. Often it is in the workplace, and even more in the leisure and games industries, and as a result, many learners will come to education and training much more familiar with the technology than the teachers. This may be personally threatening for teachers, especially in cultures where the authority of the teacher is highly respected. It makes the skilled teacher more a manager of learning, and less a source of knowledge or authority -- since learners will increasingly be at ease with the technologies, which give them direct access to the knowledge base. Learning with a teacher is likely to become increasingly democratised: the model will become "learning together" rather than "learning from". In this context the French example, using the technology itself to provide training in the technology provides an interesting experiential approach to the problem. The Italian strategy, of making training in information technology part of the compulsory training of teachers, provides an important foundation on which to build, as long as it can win "hearts and minds" and not merely token participation.

The technologies do not only affect teaching staff. They also create new roles for "para-teaching" staff -- resource managers, tutorial advisers, designers, and technicians. The need to reshape how people do their jobs in a more complex and flexible "education industry" raises particular problems for those cultures where industrial relations in education have been confrontational, or are strongly based around particular forms of education delivery. There remains an understandable fear that the introduction of technologies will destroy teachers' jobs. The effective management of change requires mutual trust, without which institutions may become frozen, unable to change, while their roles are taken over by other, more flexible agencies. Such a development would not necessarily help access for learners, nor the long term interests of teachers in public institutions.

The cultivation of trust, between government, institutional managers and staff is critical, and it requires managers and policy makers to recognise the very great personal and professional challenges facing teachers as they respond to the long term needs for both learners and society. A central element of this, touched on by several papers, was the importance of managing staff workloads. New kinds of function can be very time consuming: and the long term savings of materials based learning are not always as great as anticipated, particularly when material needs frequent updating. More unfamiliar to most teachers, accustomed to having timetables, rooms with doors, and buildings to leave at the end of the day, is the workload which can be generated by the unplanned use of e.mail and the Internet.

Finally, technologies can also transform the role of learners in mutual support. Informal peer support has always been a part of adult learning, but where groups are meeting in isolated locations, communicating with the teacher infrequently via satellite or cable connections, the use of the student group as an educational resource can be even more important.

Changing institutions

The technologies will transform many, if not all, education and training institutions. Most countries already have institutions which offer mixed mode delivery, of different programmes, or sometimes the same programmes. In addition, many OECD countries, including the United Kingdom, the Netherlands, Spain, Japan and the United States, have established radically different kinds of educational institution to take advantage of the technologies. Such institutions take different forms, with new kinds of staff and often with staff and buildings in remote sites. But although the well known models, like the Open University in Britain, are very large and complex, they do not have to be so, as the Spanish example illustrates. However, the changes will also affect "traditional" institutions, which will also have to come to terms with new ways of using staff and resources, and with competition from new forms of institution and service.

The technology is creating, for the first time, a global market in education and training. For many years, higher education institutions have recruited students from other countries, but this involved only the tiny minority able and willing to travel, and live, sometimes for several years, abroad. The new potential to offer programmes in other countries without either student or teacher leaving home may well have a major impact on the shape of the global education and training system. To date there is only modest evidence of this, although it is developing in some areas of management education, like "Internet MBAs", and there is a growing group of distance learning institutions who see their potential market as global. However, the Norwegian case demonstrates that the existence of the technology and materials to deliver education globally (and in a widely spoken language) do not, by themselves, guarantee a market demand. There are other issues too: the acceptability of qualifications, and of particular forms of tuition in different cultures. The management of relationships between institutions is likely to become more complex, and it is not yet clear that member states have fully grasped the implications in areas like intellectual property law.

One important issue is the ways in which institutions work with each other, within and across national boundaries, and between public and private sectors. In some cases, like the Danish one, distance education is offered through a collaboration between local institutions and remote ones, neither with great experience of distance learning. On the other hand, the Open University in Britain has used local educational institutions to provide study centres since its foundation 25 years ago, but without any direct educational relationship. Collaboration is also likely to increase in course design, especially where courses are complex and involve multiple media. Institutions will have to develop complex ways of working, co-operating over some issues and competing over others. In countries where a competitive market in education has been actively encouraged this may seem a natural process, but for those with a stronger tradition of a public sector monopoly in education the encounters may be more difficult.

Choosing appropriate technologies

There is a danger that policy makers will assume that the choice of technology is a simple one. Communications technologies take many forms and the precise combination appropriate for a particular purpose and situation will vary. Nor are the most appropriate technologies necessarily the obvious ones -- the Spanish paper noted that "one of our most important discoveries was the classroom" -- and several of the cases reported made much use of physical buildings, even while using technologies with the power to reach into the home.

The New Zealand paper offered a useful reminder of the distinct roles of three broad kinds of technology -- broadcast, telecommunication and computer based -- each of which has a particular contribution to make:

	Broadcast	**Telecomms.**	**Computer**
time	synchronous	synchronous	asynchronous
interactivity	non-interactive	interactive	interactive
modifiable	low	high	moderate/high
location	home	centre	home
fixed costs	high	moderate	high/moderate
variable costs	low	moderate	moderate/low

The papers which follow describe cases in all three categories, to which might be added a fourth -- projects which aim to support staff in working with the technologies.

One clear area of agreement was the importance, not only of selecting appropriate technology for the specific purpose and situation, but also of selecting technology which is reasonably accessible, robust and affordable. In practice, the cycle of renewal of hardware in educational institutions will never be able to keep up with improvements in the technology, and if systems are to be implemented they will often be better based on commonly available, rather than "state of the art" hardware. This is also likely to be the case with home based systems, where students may have access to a wide range of equipment. The Spanish case involves the use of a technology which was relatively primitive, but which made it possible to offer cheap, standard price communications facilities which could not have been afforded if faster and more interactive systems had been chosen.

The integration of learning and life also points to the need, wherever possible, to use software and hardware which is already in widespread use. Commercial producers can devote far greater resources to development of software for standard processes like word processing or email, and it is foolish for educators to try to compete, unless there are very clearly distinct educational purposes. Furthermore, these are the systems which adult learners wish to use, and often are already using, in their homes and workplaces. The Norwegian learners who enrolled on the Internet course were at least as interested in having access to the Internet, and the skills of using it, as to the formal course content itself.

Equality and exclusion

The technologies can open access to those who were previously unable to participate in formal learning, taking opportunity to people who have been excluded by distance, time or social status. They can not only enable people to learn at times which are convenient to them, but to communicate asynchronously -- both learners and teachers can send messages at times which suit them, whatever the recipient is doing at the time. The United States project with homeless people in Philadelphia demonstrates that they can contribute to overcoming serious social exclusion. However, it also demonstrates the importance of public resourcing, since unregulated markets are likely to reinforce the advantages of those who already have the best access to both learning and technology.

The changes can also be complex and paradoxical -- opening access for some while closing it for others. Learning in the home opens access for some, but the home is not always the best place to learn, and such approaches may actually disadvantage some learners with domestic responsibilities who no longer have "protected time and space" for study, while invading the space of family and community life. Similarly, some technologies will not help in extreme cases -- some forms of communication will never reach the far north of Canada, and if its government only achieves its target of covering 80 per cent of its population by the year 2000 the effect will be to deepen the exclusion of the remaining 20 per cent. This is not a reason for trying to resist the primary change, but it does make it important to consider alternative strategies to deal with marginal populations, and to monitor change carefully for unexpected new areas of exclusion.

The quality of what is offered is also important. If the technologies open access only to learning which leads to second rate, or inappropriate, qualifications, we will not have succeeded. There is a further danger that, as a global market in education and training develops we will import education and training solutions from inappropriate contexts, providing learners with qualifications which they cannot use. This points clearly to the importance of providing guidance to assist learners in making wise choices between the increasing variety of opportunities, and of a more sophisticated understanding of cultural difference.

Missing topics?

There were a number of issues which anyone reading the papers in advance might have expected to figure more prominently in the discussions. They include:

Who initiates?

Although this was a conference of policy makers, there was relatively little discussion of who should intervene, and how, in development. It is not clear how far there is a consensus about the role of the various players -- the state, the market, the institutions, teachers, employers and learners. This perhaps reflects a sense that the pressures of the market and technical development are inexorable, but nevertheless, the case studies demonstrate clearly that governments can intervene effectively. They also show that intervention is not a simple issue. Some governments, committed in principle to a free market in education and training (like the United States and the United Kingdom), nevertheless choose to intervene heavily, in infrastructure, resources or regulation of the market. Some, like Korea, intervene by providing standard tools, encouraging consistency in software development, without imposing patterns on the content of that material. Others, like New Zealand, intervene through support to pilot studies, while firmly refusing to intervene in the market itself.

Content

It was notable that there was almost no discussion of the content of educational programmes -- of what is to be taught. This is partly because participants had been selected for their knowledge of technological and policy issues rather than curriculum, but nevertheless there is a danger that such discussions become detached from application in the real world. While, in post school learning, much content may be a matter best left to the market, rather than to policy makers, it might nevertheless be worth examining the nature of the basic "core skills" required to use the technology, as well as the application of the technologies to the teaching of basic communication skills required for full participation in the social and economic life of the community.

Partnerships

Some of the cases quoted involved partnerships between education providers or between education providers and private sector firms. The question of what is best done in public and private sectors, and how expertise and resources can best be shared, in what is often a complex and expensive field, where private sector firms are often ahead, both technically and in thinking through implications, is one worth more exploration. However, as one Asian delegate observed, different OECD countries have very different notions of the nature of the boundaries between public and private.

Incentives

There was some discussion about why teachers resist the introduction of new technology, but little discussion of whether the incentives built into career progression, status among peer groups, and financial reward, support or discourage them. Some resistance to change may be rational and possibly right, and some has its roots in inadequate information or insufficient time to debate and understand. Some, however, has its roots in "perverse incentives" built into the operation of existing systems.

Issues and conclusions

It would be inappropriate to seek to draw firm conclusions from a three-day discussion of such a diverse collection of materials. However, a number of key issues did emerge on which there was considerable agreement:

Funding implementation

The greatest costs, and the most difficult problems in applying information technologies in lifelong learning are human, not technical. This is often not understood by those who initiate change, who underestimate the need for awareness raising, for embedding the technology in the workings of educational systems, for rethinking organisational structures, and for practical instruction and ongoing support to individuals and institutions in using the technologies.

Improving evaluation

Too little attention has been given to the evaluation of different approaches to the use of information technologies in learning, and there is a particular failure in many countries in exchanging knowledge about this between the private sector (where some technologies are much more advanced) and the public.

This is both a quantitative and qualitative issue. At present there is inadequate quantitative information about the extent and nature of technology use in education to enable countries to make comparisons, or researchers to identify examples for study. Nor are the qualitative issues easy: the implications of cultural difference are easy to underestimate, and it is also important to avoid simplistic models of effectiveness which focus more on cost, and readily measurable indicators than the broader, and sometimes very long term outcomes. Social and cultural outcomes of lifelong learning are as important as economic ones, and our understanding of learning gain in adult learners is itself not well developed. The case study approach adopted at Philadelphia remains powerful, and the development of a more refined approach to generating and comparing case studies may be an important way forward.

Understanding access

When introducing a new technology it is important to monitor and review its impact on who has access to learning. Most technologies increase access for some, and reduce it for others, either because of who has access to the technology itself, or because of how it is used. The development of a new communications technology may provide access to many new groups, while increasing the disadvantage of those beyond its reach, financially, culturally or geographically.

Selecting appropriate technologies

There is no such thing as "the best" way of applying technology to learning. Every situation is different, and most situations benefit from a mix of technology, which will vary by location, culture, learner and institutional context (among other factors). Sometimes unexpected combinations of technology prove the most effective, and there will be purposes for which books and formal lectures remain the most effective tools.

The speed of technical change makes equipment rapidly obsolete, and means that educational institutions are often working with technology considerably less capable than the current "leading edge". Budgeting needs to allow for constant upgrading, and those designing educational systems may need to pay more attention to what technology is widely available, than to what the latest technology can do. Where good commercial software and hardware exists it is probably better to use this, than to design special materials for educational purposes.

Securing infrastructure

The issue of what infrastructure is needed to support new technologies in learning, and how that can be best provided was touched on during the discussions, but not explored in depth. In some countries like the United Kingdom and the United States there has been substantial government commitment to developing broadband communication between educational institutions, either through public funds or through systems of regulation. In others the matter is left more in the hands of the market. It is clear that guaranteeing access for lifelong learners will require more than cabling schools and colleges. More thought is needed to how, and on what terms, the whole population (which is the target of any lifelong learning approach) can be brought within the scope of a "Universal Service".

Developing staff skills and commitment

The enthusiastic participation of staff in development will be critical to its success. This will include support for those who undertake teaching roles as volunteers, supervisors, members of peer learning groups, and community leaders, as well as those formally employed as "teachers". There would appear to be a real danger in some countries that in the development of the commercial IT market, teachers will be left behind. The larger and richer markets of private company training schemes, of training by software houses (where "training" on software is increasingly embedded in the products themselves), and of the commercial games market, are expanding access and skill rapidly in the population. Teachers and educational institutions may increasingly find themselves working with students, parents and employers all of whom are more at home with the technologies than they are themselves. This provides opportunities and challenges, to teachers to develop their skills and learn to live with less hierarchical notions of their own authority, and to governments to consider how to ensure access for those who will never be a profitable market, and whose exclusion from society in general will be deepened as others move further ahead.

Learning from each other

The diversity of OECD countries provides an rich environment for the study of the impact of technology on learning. However, the difficulty of comparing educational practice across national and regional boundaries must not be underestimated. Those familiar with the technology and the international debates on education and training can easily underestimate how fundamental are the differences between their cultures, which reflect deep rooted and important differences in values. This is a sensitive issue, since education is one of the key ways in which national identity and culture is transmitted and maintained.

The technologies also create a flow of values between cultures, of a kind which we have never experienced before. Since the natural tendency of an unregulated free market is to converge rather than diversify, the economies of scale make it possible that much teaching material will come to adopt a single cultural form and perspective, and a single language. This might be very convenient for those whose first language is English, but would be profoundly damaging to individual countries, and to the cultural diversity from which the global community benefits.

Nevertheless the Philadelphia meeting demonstrated the power of cross national comparisons, and the need to refine the methodologies. We need better ways of understanding how and why we differ, and of creating tools for observing practice across boundaries. Perhaps the most illuminating case studies were those which described in considerable detail a particular piece of learning: "telling a story" in detail so that one could engage not in the framework but in the underlying thinking. The development of strategies for cross cultural observation of this sort is an important issue.

Postscript

At the end of the Philadelphia Roundtable, I presented the outline of this overview. Several members suggested that it represented pieces of a jigsaw, and asked that the printed version should "put the pieces of the jigsaw together, so that we can see the whole picture". In one sense this paper has attempted to do this, but in another the request is inappropriate. What we are considering is not a jigsaw, it is an ecosystem in constant evolution. We must observe, and monitor, remaining constantly sensitive to change in unexpected parts of the system, and in dimensions we have not thought about before. One thing we have learned from the end of the industrial age is that simple solutions to complex ecological problems can have entirely unexpected and catastrophic effects.

Despite the difficulties, we continue to need to plan, and to learn from each other. This volume is a contribution to the process, but the world will always surprise us, and it changes as we discuss it. As we move forward we must always remember that we will probably get much of it wrong. We might do well to remember the remark attributed to a British Minister at the end of the 19th century:

> "The telephone may be applicable in America, but here in Europe we have an entirely adequate supply of messenger boys".

PHILADELPHIE : EN AVANCE DE 50 ANS

par
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Introduction

Les technologies nouvelles, à l'instar des révolutions, ont toujours du bon et du mauvais. Elles permettent d'agir plus vite, plus facilement et avec une plus grande efficience. Elles permettent de faire des choses nouvelles que nous n'aurions jamais imaginé pouvoir faire, et font qu'il est difficile, même quand nous le souhaitons, de réaliser selon des méthodes anciennes ce que nous faisions dans le passé. Tout comme les offrandes dans la mythologie grecque, chaque bienfait a son prix. Il en va de même de l'application des technologies de l'information à l'apprentissage.

C'est parce que les technologies de l'information ont une incidence importante sur la société et l'enseignement que les décideurs doivent s'efforcer de comprendre et d'anticiper le changement. S'ils ne le font pas, il peut en résulter une catastrophe économique, et tout changement non maîtrisé peut avoir pour effet d'accentuer les inégalités et la fracture sociale. Toutefois, du fait que nous ne connaissons pas bien les technologies et qu'elles sont imprévisibles, nos prédictions seront souvent erronées.

Parallèlement aux progrès des technologies, les décideurs s'intéressent également à l'apprentissage à vie. L'OCDE demande depuis de nombreuses années que l'on prête davantage attention à cette question, et la décision prise par l'Union européenne de faire de l'année 1996 “L'année européenne de l'éducation et de la formation tout au long de la vie” n'est qu'un signe de la progression rapide de cette question dans l'échelle des priorités politiques de la plupart des pays développés. Les gouvernements commencent enfin à se rendre compte que dans un monde en mutation accélérée, il est insensé de s'occuper exclusivement de la formation initiale qui ne peut remplacer les compétences de la population active qu'à un rythme de 2-3 pour cent par an.

Les deux questions sont étroitement liées car les technologies de l'information contribuent à créer le besoin d'apprentissage à vie et apportent également une aide pour répondre à ce besoin. C'est cette interdépendance qui a conduit l'OCDE, conjointement avec le *National Council for Adult Literacy* (conseil national pour l'alphabétisation des adultes) des Etats-Unis, à convoquer au printemps de 1996 une “Table ronde” à Philadelphie. Il se trouve que l'événement a coïncidé avec le 50e anniversaire du lancement, à Philadelphie, du premier calculateur numérique électronique (ENIAC) du monde -- ce qui permet de voir le progrès réalisé en si peu de temps.

Cette table ronde a réuni des représentants des gouvernements et des secteurs de l'éducation de 20 pays développés pour examiner à l'aide d'exemples comment les technologies sont utilisées dans l'enseignement pour adulte, et voir s'il est possible de déceler des caractéristiques et des orientations communes. Le présent ouvrage est établi à partir de ces études de cas, et le présent document a pour objet de recenser certaines des conclusions dégagées.

Messages clés

La synthèse qui suit est consacrée à huit messages clés que les débats ont fait apparaître :

- les problèmes les plus délicats et ceux qui entraînent les coûts les plus élevés sont, non pas techniques, mais humains ;
- la diversité culturelle des Etats Membres de l'OCDE aura d'importantes conséquences pour l'utilisation qu'ils feront des technologies ;
- la notion d'apprentissage à vie est plus vaste que celle "d'enseignement pour adulte" ;
- les systèmes d'enseignement et de formation devront être axés non plus sur l'enseignement mais sur l'apprentissage ;
- les technologies de communications engendreront des changements fondamentaux dans les fonctions du personnel ;
- les technologies de communications engendreront des changements fondamentaux dans la nature des institutions (y compris les établissements d'enseignement) ;
- la technologie la plus appropriée n'est pas toujours celle qui est la plus compétitive ;
- sans intervention des pouvoirs publics sur le marché, les technologies ne réduiront probablement pas les inégalités sociales ou les inégalités devant l'enseignement.

Enfin, on repérera un certain nombre de questions ou de conclusions que les débats ont fait apparaître et qui chacune pourrait faire l'objet de débats et de recherches complémentaires.

L'impact des technologies

Comme chacun en est convenu à Philadelphie, les technologies qui déterminent qui a accès à l'information et au savoir et comment les personnes communiquent entre elles, ne sauraient être en marge du débat politique, économique ou social. L'un des intervenants a fait observer que si la révolution industrielle avait créé une scission entre la vie professionnelle et la vie personnelle, la révolution des technologies de l'information pourrait réintégrer ces deux milieux, en déplaçant certaines des frontières les plus fondamentales qui établissent une distinction entre nos cultures. En réponse à l'exposé du Royaume-Uni, Sylvia Ostry a fait valoir que la révolution des technologies de l'information se différencie qualitativement parlant des évolutions de ce genre qui l'ont précédée. A la différence des révolutions agraire et industrielle, la révolution de l'information touche le secteur des services, et autant l'activité du secteur public que celle du secteur privé. Nous ne savons guère, a-t-elle précisé, comment l'innovation se produit dans le secteur public, or c'est dans ce secteur que les cultures nationales exercent leur influence la plus grande. La révolution de l'information modifie non seulement notre mode de vie mais aussi l'idée que nous avons de nous-mêmes.

En redistribuant l'information et le savoir, ces technologies modifieront les structures de pouvoir et d'autorité au sein des organisations (y compris les établissements d'enseignement) et nos modes de travail. Elles nous obligent également à repenser nos systèmes éducatifs en donnant plus d'attention à la formation des adultes, en revoyant la façon dont nous préparons les jeunes à la vie adulte, en insistant sur l'autonomie de l'apprenant, en privilégiant dans les systèmes et dans les pratiques non plus l'enseignement mais l'apprentissage, et en modifiant la répartition des prestations d'enseignement entre le secteur public et privé. Point plus fondamental, en redéfinissant la façon dont les personnes ont accès à l'information et au savoir, les technologies soulèvent des questions tout à fait nouvelles sur la façon dont le savoir est créé et à qui il appartient.

La rapidité avec laquelle les technologies elles-mêmes changent ajoute encore à la complexité en gommant de nombreuses distinctions "traditionnelles" d'une part entre des domaines comme l'"éducation" et les "activités de loisirs", et d'autre part entre des catégories bien connues telles que les "technologies de l'information", les "techniques éducatives", les "télécommunications" et l'"informatique". Dans le présent document, nous nous bornerons à utiliser le terme "technologies" pour embrasser ce large éventail.

Le problème humain

Les problèmes cruciaux sont non pas techniques mais humains, tel est peut-être le principal message à retenir de la table ronde de Philadelphie. Il y a été question à maintes reprises de la façon dont les personnes apprennent à utiliser les technologies et des raisons pour lesquelles elles opposent une résistance. Plusieurs orateurs nous ont rappelé que la plus grande partie des dépenses (plus de 90 pour cent d'après l'un d'entre eux) à supporter pour appliquer les technologies à l'apprentissage servent non pas à acheter matériel et logiciels mais à permettre aux personnes de les gérer et de les utiliser, à conduire des activités de sensibilisation, à assurer des formations et à restructurer les organisations. Un certain nombre d'intervenants ont fait observer que la résistance apparemment irrationnelle au changement est souvent une réaction tout à fait raisonnable face à une consultation insuffisante, à une mauvaise implantation et à l'absence de formation, d'information et d'aide.

Du fait de la dimension humaine, les efforts faits pour apprendre les uns des autres sans tenir compte des frontières nationales sont à la fois stimulants et mobilisateurs. Les êtres humains vivent dans des communautés, -- il peut s'agir d'un lieu, d'une langue, d'une famille et d'une nation -- qui au tréfonds sont liées par leur culture et leurs valeurs. Nos différences ne tiennent pas simplement au fait que nous utilisons des mots différents pour désigner la même chose ; nos langues respectives donnent une vision différente de l'être humain et de ce que sont de bonnes relations entre personnes (y compris entre les enseignants et les apprenants). Un spécialiste des différences culturelles a observé deux chaînes de production industrielle, l'une au Japon et l'autre aux Etats-Unis. Apparemment, les deux étaient identiques : au bout de chacune d'elles se tenait un inspecteur qui examinait les produits sortant de la chaîne et repérait ceux qui n'étaient pas conformes aux normes requises. Toutefois, une fois interrogé, l'inspecteur des Etats-Unis a estimé que sa tâche consistait à repérer les produits "défectueux" afin d'identifier et de sanctionner la personne responsable alors que l'inspecteur japonais a fait savoir qu'il recherchait les possibilités d'apprendre ainsi que les différences susceptibles d'améliorer les produits ou d'en mettre au point de nouveaux. Au-delà de cette opération en apparence identique, les systèmes de valeurs dans ces deux pays ainsi que l'idée que l'on s'y fait des objectifs à atteindre et des relations humaines sont profondément différents. Lorsque nous changeons de moyens de communication et d'interlocuteurs, ce sont les racines de nos cultures que nous transformons.

Diversité culturelle

Si, économiquement parlant, les pays Membres de l'OCDE ont beaucoup en commun, ils sont très divers du point de vue culturel, social et géographique. Cette diversité est une source de grande richesse pour les débats qui se déroulent dans l'Organisation au sujet de l'apprentissage à vie : l'Espagne, le Canada et le Danemark ont en commun à coeur de doter des communautés géographiquement isolées de services éducatifs mais il n'y a pas d'équation simple entre les problèmes que connaissent le nord du Canada, les îles danoises et la région rurale castillane. De même, les cultures nationales n'adoptent pas les mêmes attitudes à l'égard des technologies ou de l'apprentissage. Les Australiens en règle générale adoptent les technologies avec enthousiasme : depuis les radios scolaires dans les années 50 jusqu'à la classe organisée par vidéoconférence dans le sud de l'Australie dans les années 90, ce pays a tiré parti des technologies pour surmonter l'isolement géographique en créant une "communauté virtuelle". Les Danois, en revanche, assurent depuis fort longtemps à l'échelle locale un enseignement pour adulte avec un taux de participation très élevé en face à face pédagogique. Pour les Danois, l'éducation est une activité sociale, et leur résistance à la technologie témoigne peut-être d'un attachement sain à la vie collective plutôt que d'une obstruction au changement. L'idée défendue par les Danois "qu'il est agréable d'apprendre ensemble" est envisagée tout à fait différemment par les Japonais qui ont pour souci de préserver des formes d'enseignement privilégiant plutôt les aspects sociaux que purement économiques. Les Suisses, dans leur rapport, nous rappellent que même dans un petit pays, l'attitude à l'égard des technologies peut varier d'un groupe linguistique et culturel à l'autre.

Apprentissage à vie

L'instruction prépare les personnes à vivre dans la communauté adulte : l'apprentissage à vie en fait partie. Les systèmes scolaires peuvent se charger de cet apprentissage pendant une durée limitée : les apprenants sont scolarisés, qu'ils le veuillent ou non, et la mission de l'école s'achève quelques années plus tard à la fin de la scolarité. L'apprentissage à vie, en revanche, consiste tout d'abord à sensibiliser les personnes, à les motiver et à les convaincre qu'apprendre est un moyen de résoudre leurs propres problèmes et de répondre à leurs besoins. Ces démarches nécessitent des processus complexes d'orientation et de négociation pour faire correspondre l'apprentissage aux besoins des individus et des groupes. De plus, ces apprenants n'ont jamais "fini", bien qu'ils puissent passer d'un prestataire de services éducatifs à un autre et accomplir une grande partie de leur apprentissage en dehors de tout établissement d'enseignement.

Le rôle des technologies dans l'enseignement pour adulte est de la même façon complexe. Certaines, telles que les émissions télévisées, peuvent contribuer à sensibiliser ou à motiver les personnes tandis que d'autres peuvent être particulièrement utiles pour évaluer les résultats des personnes qui ont suivi des apprentissages dans toutes sortes de lieux et selon des méthodes variées. D'autres encore peuvent aider les apprenants à choisir judicieusement leurs itinéraires de formation ou à planifier leurs carrières futures. Le fait de se situer dans la perspective de la vie tout entière nous rappelle également qu'une grande partie de la formation des adultes (et peut-être la majeure partie) s'est toujours passée en dehors des murs des établissements d'enseignement proprement dits. Si nous entendons mettre en place une société de l'apprentissage, nous devrions chercher à savoir comment les technologies peuvent étayer ce type-là d'apprentissage en même temps que les formes plus structurées.

Dans une économie et une société fondées sur le savoir, l'apprentissage ne vient pas se "greffer" sur des mécanismes sociaux et économiques stables : il modifie ces mécanismes, et permet aux sociétés d'engager une réflexion sur elles-mêmes et de se redéfinir. Dans son rapport, la Corée attire l'attention sur le rôle que l'apprentissage à vie joue dans le "constructivisme social" : c'est un des moyens par lesquels nous reconstruisons nos sociétés, que l'Etat choisisse d'intervenir activement, comme c'est le cas dans plusieurs pays d'Asie, ou qu'il laisse les mécanismes du marché jouer avec un minimum de contraintes, comme c'est le cas en Nouvelle-Zélande.

L'apprentissage à vie modifie également les rapports entre les contenus et les modalités de l'apprentissage. Si nous devons continuer d'apprendre tout au long de notre vie, nous devons devenir de meilleurs apprenants, et il faudra que les systèmes éducatifs consacrent plus de temps à nous aider à comprendre et à améliorer nos capacités d'apprentissage et moins à transmettre les "contenus" d'enseignement. Selon Paul Kirschner, Pays-Bas, 50 pour cent seulement des formations proposées par l'université à distance consistent à transmettre des "contenus" au sens traditionnel. Les autres consistent à engager une réflexion sur la formation proprement dite, et autrement dit à expliquer sa finalité, à suggérer comment l'aborder, l'organiser et y réfléchir, à illustrer les différents problèmes, à vérifier les acquis et à la rattacher au monde extérieur. A un niveau plus théorique, Graziella Tonfoni, Italie, plaide pour une plus grande réflexion sur le processus d'apprentissage. En "ralentissant" l'acquisition des connaissances et en adoptant des méthodes d'apprentissage plus actives, nous améliorons l'efficience des capacités d'apprentissage elles-mêmes.

Dans un monde de transformations accélérées et d'apprentissage à vie, la place relative de la théorie et de la pratique, ainsi que l'autorité des enseignants, changent également. En Europe, depuis le XVIIe siècle, la création et la transmission du savoir est un processus apparemment linéaire. Pour dire les choses simplement, les chercheurs observent le monde réel, définissent un savoir fondé et formulent des théories, qu'ils transmettent ensuite aux élèves ou étudiants. Le savoir est créé par cette petite communauté de "spécialistes", à laquelle il appartient. Ce monopole du savoir validé donne un grand prestige aux spécialistes ; on accorde plus de prix à la recherche et à la théorie qu'à l'apprentissage et à la pratique ; et on attache plus d'importance à la réflexion abstraite qu'à la résolution des problèmes.

Ces relations se transforment dans un monde où le savoir prend rapidement de l'extension, et devient beaucoup plus accessible. Les personnes qui participent à la création et à la transmission du savoir sont infiniment plus nombreuses : tout en étant plus accessible, le savoir est moins facile à gérer ; quant à la théorie, elle est plus souvent testée au regard de problèmes pratiques. Cette évolution va remettre en question toutes les cultures mais surtout celles qui ont de tout temps accordé une place privilégiée aux connaissances théoriques et celles qui ont établi une scission profonde entre le savoir professionnel et l'érudition classique car, de plus en plus, savoir-faire et savoir n'iront plus l'un sans l'autre.

La relation entre l'individu et l'organisation est liée à cette évolution. Nous assistons à l'essor des "organisations en situation d'apprentissage", qui sont non pas seulement des entreprises où tous les salariés suivent des formations (cela marquerait, il est vrai, un progrès), mais des organisations entièrement tournées vers la nécessité de constamment apprendre et s'adapter. Comme Kaisa Kautto-Koivula, Finlande, l'a fait valoir en réponse à l'exposé de l'Allemagne, ce type d'organisation "apprend" de la même façon qu'un individu, et peut ce faisant se heurter aux mêmes problèmes (une mémoire déficiente par exemple). Dans le même temps, des liens d'un type nouveau se créent entre l'apprentissage et le travail. L'exemple, présenté par Peter Schenkel, de la formation à domicile assurée par Bosch montre comment la formation liée à l'activité professionnelle se déplace, étant non plus dispensée pendant le temps de travail et sur le lieu de travail mais chez le salarié lui-même : à l'image des offrandes dans la mythologie grecque, cette solution a des bienfaits dont la signification véritable n'est évidente qu'a posteriori.

De l'enseignement à l'apprentissage

L'apprentissage à vie appelle à s'intéresser moins à l'enseignement et davantage à l'apprentissage : moins à ce que les enseignants estiment devoir enseigner et davantage aux problèmes que les apprenants doivent résoudre. Un programme d'apprentissage ou de formation "cohérent" se définit par rapport à ce qui est rationnel pour l'apprenant compte tenu de ses acquis et de sa situation propre, et non plus par rapport à ce qu'un professeur qualifie de domaine intellectuel.

Désormais, il est également crucial que les apprenants deviennent autonomes. Dans son rapport, l'Australie signale que les élèves suivant la classe à distance par vidéoconférence étaient plus actifs, interrompant et contestant l'enseignante beaucoup plus que ceux qui étaient en classe avec elle. Comme les groupes étudiés dans l'étude danoise, les élèves australiens cherchaient à devenir maître de leur propre apprentissage. Nous devons favoriser ce genre d'indépendance dans la mesure où l'apprentissage à vie ne saurait se fonder sur la présence permanente d'enseignants. Cette autonomie ne sera acquise que si chaque personne est un apprenant compétent et sûr de lui, que s'il est en mesure de voir comment l'acquisition de connaissances va lui permettre de résoudre ses problèmes particuliers et que s'il est capable de choisir judicieusement ses modes d'apprentissage.

Comme il est signalé dans les rapports suisse et allemand, les technologies nous permettent d'appréhender les différences plus complexes entre les individus. Nous pouvons reconnaître davantage de formes de savoir et d'intelligence et n'avons plus à agir comme si tous les apprenants avaient recours au même mode d'apprentissage. Toutefois, il nous faut encore comprendre les conséquences pédagogiques de nombre des outils à présent à notre disposition, et la pédagogie sur laquelle repose une grande partie des apprentissages fondés sur la technologie demeure très peu élaborée.

Il sera essentiel de doter aussi bien les individus que les machines de capacités de gestion de l'information. Il peut être ingrat d'apprendre à s'y retrouver dans un domaine de savoir nouveau ou dans une bibliothèque inconnue, mais lorsque chacun de nous aura accès à toutes les bibliothèques du monde, cela sera impossible sans outils de navigation, de sélection et d'analyse beaucoup plus perfectionnés. De même, la messagerie électronique nous libère des contraintes de lieu et de temps et permet aux humains de créer beaucoup plus de messages qu'ils ne peuvent en lire. Dans le secteur éducatif, la messagerie électronique amène les apprenants isolés à exercer sur les enseignants des pressions absolument ingérables, et ceux qui mettent au point des systèmes d'apprentissage fondés sur ce moyen de communication devront trouver des stratégies pour résoudre ce problème.

Les rôles nouveaux des enseignants

Certes, les enseignants rencontreront peut-être les apprenants moins souvent dans des face à face pédagogiques, et ils le feront selon des modalités différentes, et dans plusieurs études de cas, on note comment l'adoption de nouvelles technologies oblige les enseignants à repenser la façon dont ils planifient et organisent leur travail, ainsi que l'intelligence qu'ils ont de leur discipline. Les enseignants s'intéressant pour la plupart à leur discipline et à la façon dont ils l'enseignent, beaucoup se félicitent d'être obligés de revoir leur propre perception, travaillant parfois en équipe avec d'autres collègues. Mais des démarches de ce genre prennent du temps, qui d'ordinaire fait défaut, et ceux qui sont habitués à dispenser leur enseignement en toute liberté, adaptant les leçons de chaque semaine aux progrès accomplis la semaine précédente et établissant des liens avec les sujets d'actualité, auront du mal à accepter les délais beaucoup plus longs imposés par certaines technologies.

Nous sommes habitués à ce que les enseignants sachent répondre aux questions posées ; quant aux enseignants, habitués à jouir d'une autorité incontestée qu'ils tirent de leur maîtrise à la fois de leurs connaissances et de la façon dont ils les transmettent, ils auront beaucoup de mal à admettre leur ignorance. Lorsque les délégués se sont rendus à l'Unité des sciences informatiques à l'Université de Pennsylvanie, on a fait observer que le moteur du changement technologique ne se trouve pas dans l'éducation. Cette force motrice se trouve souvent sur le lieu de travail, et encore plus dans les activités de loisirs et de jeux, et de ce fait, de nombreux apprenants arrivent à l'enseignement et à la formation en étant bien plus au courant de la technologie que ne le sont les enseignants. Cette situation peut constituer une menace personnelle pour les enseignants notamment dans les cultures où l'autorité de ces derniers est hautement respectée. L'enseignant qui maîtrise la technologie devient davantage un gestionnaire de l'apprentissage et moins une source de savoir ou une autorité -- dans la mesure où les apprenants connaîtront de mieux en mieux les technologies leur permettant d'accéder directement à la base de connaissances. Il est probable que l'apprentissage avec un enseignant va se démocratiser de plus en plus : il s'agira plutôt "d'apprendre ensemble" que de "bénéficier d'un enseignement". A cet égard, l'exemple de la France qui utilise la technologie elle-même pour former à la maîtrise de la technologie constitue une tactique intéressante pour résoudre le problème. La stratégie de l'Italie qui consiste à intégrer la formation aux technologies de l'information dans la formation obligatoire des enseignants constitue une bonne base, pour autant que cette formation emporte une véritable adhésion et non pas simplement un semblant de participation.

Les technologies n'ont pas des conséquences uniquement sur le personnel enseignant. Elles sont également à l'origine de rôles nouveaux pour le personnel para-enseignant -- les gestionnaires de ressources, les conseillers d'éducation, les concepteurs et les techniciens. Il faut revoir la façon dont les personnes exercent leurs fonctions dans un "secteur de l'éducation" plus complexe et plus flexible et cette exigence pose des problèmes particuliers dans le cas des cultures où les relations professionnelles dans le domaine de l'enseignement ont été conflictuelles, ou bien s'articulent solidement autour de formes particulières de prestations éducatives. On continue de craindre, ce qui est compréhensible, que l'adoption des technologies détruise le métier d'enseignant. La bonne gestion du changement nécessite une confiance mutuelle sans laquelle les institutions pourraient se figer, se montrer incapables d'évoluer, tandis que leurs fonctions seraient assumées par d'autres organismes faisant preuve d'une plus grande souplesse. Une évolution de ce genre ne favoriserait pas nécessairement l'accès des apprenants au savoir ni l'intérêt à long terme des enseignants pour les institutions publiques.

Il est capital d'entretenir la confiance entre les pouvoirs publics, les chefs d'établissement et le personnel, et à cette fin il faut que chefs d'établissement et décideurs reconnaissent la formidable épreuve à laquelle les enseignants sont confrontés à titre aussi bien personnel que professionnel pour répondre aux besoins à long terme tant des apprenants que de la société. Comme il est mentionné dans plusieurs rapports, il est capital à cet égard de gérer la charge de travail du personnel. Les nouveaux types de fonctions peuvent absorber beaucoup de temps : et les gains de temps que permet à long terme l'apprentissage basé sur l'utilisation de matériels pédagogiques ne sont pas toujours aussi importants que prévu en particulier lorsque ces matériels doivent être fréquemment mis à jour. Ce que la plupart des enseignants connaissent moins -- eux qui sont habitués à avoir des emplois du temps, des classes avec des portes et des bâtiments à quitter à la fin de chaque journée --, c'est la charge de travail que peut engendrer l'utilisation non programmée de la messagerie électronique et d'Internet.

Enfin, les technologies peuvent également transformer le rôle des apprenants dans l'aide qu'ils s'apportent mutuellement. L'entraide a toujours été un aspect de la formation des adultes, mais lorsque les groupes se réunissent dans des endroits isolés, communiquent avec l'enseignant peu souvent par satellite ou par câble, il peut être encore plus important d'utiliser le groupe d'étudiants comme ressource éducative.

Mutations des établissements d'enseignement

Les technologies vont transformer beaucoup d'établissements d'enseignement et de formation, sinon tous. Les pays, pour la plupart, sont déjà dotés d'établissements qui dispensent des programmes d'enseignement différents, ou parfois les mêmes programmes selon des modes de prestation différents. En outre, de nombreux pays de l'OCDE, dont le Royaume-Uni, les Pays-Bas, l'Espagne, le Japon et les Etats-Unis, ont fondé des établissements d'enseignement radicalement différents pour tirer parti des technologies. Ces établissements sont de types différents, disposent de catégories de personnel nouvelles, le personnel et les bâtiments se trouvant souvent dans des sites éloignés les uns des autres. Si certains types très connus, tels que l'*Open University* en Grande-Bretagne, sont des organismes très vastes et complexes, il peut en être tout autrement, comme le montre bien l'exemple espagnol. Toutefois, les changements influent également sur les établissements "classiques", qui devront également composer avec les nouvelles façons d'utiliser le personnel et les ressources ainsi qu'avec la concurrence qu'exercent les nouveaux types d'établissements et de services.

La technologie crée, ce qui est une première, un marché mondial dans le secteur de la formation. Les établissements d'enseignement supérieur accueillent depuis de nombreuses années des étudiants étrangers mais cette situation concerne uniquement une toute petite minorité de personnes qui sont en mesure et acceptent d'aller à l'étranger et d'y vivre parfois pendant plusieurs années. La possibilité nouvelle de proposer des programmes d'enseignement dans d'autres pays sans que les étudiants ou les enseignants ne partent de chez eux pourrait fort bien avoir d'importantes répercussions sur la structure du système d'enseignement et de formation à l'échelle mondiale. A ce jour, cette possibilité n'est exploitée qu'à une échelle limitée bien qu'elle prenne de l'ampleur dans certains domaines de la formation à la gestion, tels que les "MBA sur Internet", et un groupe de plus en plus vaste d'établissements de télé-enseignement considèrent que leurs débouchés pourraient être mondiaux. Toutefois, le cas de la Norvège démontre que l'existence de technologies et de matériels propres à dispenser un enseignement à l'échelle mondiale (et dans une langue largement parlée) ne garantissent pas en soi une demande sur le marché. D'autres problèmes sont également en jeu : la possibilité d'homologuer les titres ainsi que certaines formes d'enseignement dans des cultures différentes. La gestion des relations entre établissements va sans doute gagner en complexité, et il n'est pas encore évident que les Etats membres en aient pleinement saisi les répercussions dans des domaines tels que les droits de propriété intellectuelle.

Une question importante intéresse la façon dont les établissements travaillent ensemble, qu'ils soient situés dans le même pays, dans des pays différents et appartiennent aux secteurs public et privé. Dans certains cas, l'exemple observé au Danemark par exemple, l'enseignement à distance est le fruit d'une collaboration entre des établissements locaux et des établissements lointains n'ayant ni les uns ni les autres une grande expérience du télé-enseignement. En revanche, depuis sa fondation, il y a 25 ans, l'*Open University* en Grande-Bretagne a recours à des établissements d'enseignement locaux qui servent de centres d'études, mais qui n'entretiennent avec elle aucune relation directe ayant trait à l'enseignement proprement dit. Cette collaboration entre établissements va probablement aussi s'intensifier en ce qui concerne la conception des formations, en particulier lorsque celles-ci sont complexes et font intervenir un nombre important de médias. Les établissements devront mettre au point des méthodes de travail complexes, coopérant pour certaines questions et rivalisant pour d'autres. Dans les pays qui ont activement encouragé le jeu des mécanismes du marché dans le domaine de l'enseignement, ce processus peut paraître naturel mais dans les pays où le monopole du secteur public dans l'enseignement est une tradition solidement ancrée, ces contacts peuvent être plus difficiles.

Le bon choix de technologies

Les décideurs pourraient croire qu'il est simple de choisir les technologies, mais les technologies de communications revêtent de multiples formes et la façon précise de les associer variera selon l'objectif visé et la situation. Les technologies les plus adaptées ne sont pas nécessairement non plus les plus évidentes -- selon le rapport de l'Espagne, “l'une des découvertes les plus importantes a été la salle de classe” -- et dans plusieurs des cas cités, il est signalé que les bâtiments sont très utilisés même si les technologies permettent d'atteindre l'apprenant chez lui.

Le document de la Nouvelle-Zélande rappelle utilement les rôles distincts de trois grandes catégories de technologie -- basée sur la radiotélédiffusion, les télécommunications et l'informatique -- qui chacune ont un concours particulier à apporter :

	Radio et télédiffusion	**Télécommunications**	**Informatique**
Temps	synchrone	synchrone	asynchrone
Interactivité	non interactif	interactif	interactif
Modifiable	peu	très	moyennement/très
Lieu	domicile	centre	domicile
Coûts fixes	élevés	moyens	élevés/moyens
Coûts variables	faibles	moyens	moyens/faibles

Les documents ci-joints décrivent des cas appartenant à ces trois catégories auxquelles une quatrième pourrait être ajoutée -- celle des projets dont l'objet est d'aider le personnel à travailler avec les technologies.

Un point sur lequel tout le monde est à l'évidence d'accord, c'est qu'il importe de sélectionner non seulement une technologie adaptée à l'objet et à la situation spécifiques mais aussi une technologie qui est assez accessible, robuste et financièrement abordable. En pratique, le cycle de renouvellement du matériel dans les établissements d'enseignement ne s'alignera jamais sur le progrès technologique, et si l'on veut que les systèmes fonctionnent, il est souvent préférable qu'ils fassent appel à des matériels couramment accessibles plutôt qu'à des matériels “de pointe”. Il en sera sans doute de même aussi des systèmes utilisés dans l'environnement domestique, qui permettent aux étudiants d'avoir accès à une large gamme d'équipements. Le cas étudié en Espagne montre l'utilisation d'une technologie qui est relativement primitive mais qui a permis d'offrir des possibilités de communication à un prix standard peu élevé qui n'aurait pu être aussi bas si des systèmes plus rapides et plus interactifs avaient été choisis.

L'intégration de l'apprentissage dans la vie montre également qu'il faut chaque fois que cela est possible utiliser des logiciels et des matériels dont l'emploi est déjà largement répandu. Les producteurs industriels peuvent consacrer des ressources plus importantes à la mise au point de logiciels destinés à des procédés standards tels que le traitement de texte ou la messagerie électronique, et il est absurde que les spécialistes de l'éducation s'efforcent de leur faire concurrence sauf en cas d'objectifs éducatifs distincts très nets. En outre, ces systèmes sont ceux que les apprenants adultes souhaitent utiliser, et que souvent ils utilisent déjà, chez eux et sur leur lieu de travail. En Norvège, les apprenants qui se sont inscrits à une formation sur Internet souhaitaient au moins autant avoir accès à Internet, et être capables de l'utiliser, que bénéficier du programme de formation lui-même.

Egalité et exclusion

Grâce aux technologies, des formations structurées peuvent à présent être suivies par des personnes qui auparavant en étaient exclues pour des raisons diverses, distance, manque de temps ou situation sociale. Les technologies permettent aux personnes non seulement d'apprendre aux moments qui les arrangent mais aussi de communiquer de façon asynchrone -- aussi bien les apprenants que les enseignants peuvent envoyer des messages aux moments qui leur conviennent, quelle que soit l'occupation du destinataire à ce moment-là. Le projet des Etats-Unis axé sur les sans-abri à Philadelphie montre bien que les technologies peuvent contribuer à surmonter les situations graves d'exclusion sociale. Toutefois, ce projet met également en évidence l'importance du rôle du secteur public dans ce domaine car il est probable que des marchés non réglementés renforceront les avantages dont bénéficient déjà ceux qui accèdent le plus facilement à la formation et à la technologie.

Les changements peuvent également avoir des effets complexes et paradoxaux -- en offrant des possibilités d'accès à certains et en les supprimant pour d'autres. Les possibilités d'apprentissage à domicile ouvrent des horizons à certains mais le domicile n'est pas toujours le meilleur endroit pour apprendre ; cette solution peut en réalité jouer à l'encontre de certains apprenants qui ont des obligations domestiques et qui ne disposent plus alors "d'un temps et d'un lieu préservés" pour l'étude puisque l'apprentissage envahit l'espace de la vie familiale et sociale. De la même façon, certaines technologies ne sont d'aucune utilité dans les cas extrêmes -- certains types de communications n'atteindront jamais l'extrême nord du Canada, et si les décideurs de ce pays, conformément à l'objectif qu'ils se sont fixés, se contentent d'atteindre 80 pour cent de la population canadienne d'ici à l'an 2000, cette évolution aura pour effet d'accentuer l'exclusion des 20 pour cent restants. Ce n'est pas une raison pour tenter de résister au changement le plus élémentaire, mais ce constat montre bien qu'il faut envisager d'autres stratégies en faveur des populations marginales, et suivre l'évolution attentivement pour déceler toutes formes nouvelles et imprévues d'exclusion.

La qualité des formations proposées est également importante. Si les technologies permettent d'accéder uniquement à des formations qui débouchent sur des qualifications de second ordre ou inappropriées, nous n'arriverons à rien. De plus, à mesure que le marché mondial de la formation se développe, nous risquons d'importer des types d'enseignement et de formation inadaptés à notre situation, et de donner aux apprenants des qualifications inutilisables. Il est donc évident qu'il faut aider les apprenants à faire des choix judicieux entre les possibilités de plus en plus diverses qui s'offrent à eux, et avoir une intelligence plus fine des différences culturelles.

Questions insuffisamment traitées

Toute personne procédant à une lecture préalable des rapports aurait pu penser qu'un certain nombre de questions occuperaient une place plus importante dans les débats. Parmi ces questions, on peut citer les suivantes.

Qui a l'initiative ?

Bien que la conférence de Philadelphie ait réuni des décideurs, il a été assez peu question de ceux qui doivent intervenir dans le développement et de la façon dont ils doivent le faire. On ne sait pas au juste dans quelle mesure les avis se rejoignent au sujet du rôle des divers acteurs -- l'Etat, le marché, les établissements, les enseignants, les employeurs et les apprenants. Il faut peut-être voir en cela que les pressions du marché et du progrès technique sont inexorables, cela étant, les études de cas n'en démontrent pas moins clairement que les pouvoirs publics peuvent intervenir efficacement. Elles montrent également que la question de l'intervention n'est pas simple. Certains gouvernements, attachés au principe de la libre concurrence sur le marché de la formation (aux Etats-Unis et au Royaume-Uni), choisissent malgré tout d'intervenir massivement dans le domaine des infrastructures, des ressources ou celui de la régulation du marché. D'autres, comme en Corée, interviennent en fournissant des outils normalisés, en encourageant la compatibilité des logiciels créés, sans pour autant exiger que les contenus de ces matériels soient organisés d'une façon précise. D'autres, comme le gouvernement néo-zélandais, interviennent en apportant leur concours aux études pilotes mais refusent catégoriquement d'intervenir sur le marché lui-même.

Les contenus

Il est à noter que la question des contenus des programmes éducatifs -- c'est-à-dire de ce qui doit être enseigné -- n'a pratiquement pas été abordée. Cela tient pour une part au fait que les participants avaient été sélectionnés en raison de leurs connaissances plutôt des questions de technologie et d'orientation que des programmes d'enseignement, mais ce type de débat risque néanmoins d'être dissocié des applications dans le monde réel. S'il est vrai qu'en matière d'apprentissage post-scolaire, il est peut-être préférable de laisser les mécanismes du marché, plutôt que les décideurs, déterminer les contenus d'enseignement, il pourrait néanmoins être utile d'examiner la nature des "compétences élémentaires" à maîtriser pour utiliser les technologies, ainsi que l'application des technologies à l'enseignement des aptitudes de base à communiquer, requises pour participer pleinement à la vie sociale et économique de la communauté.

Partenariats

Certains des cas cités font intervenir des partenariats entre des prestataires de services éducatifs ou entre ces derniers et des entreprises du secteur privé. Une question mérite d'être examinée plus avant : c'est la question de savoir à quels égards les secteurs public et privé sont respectivement les plus efficaces, et comment les compétences et les ressources peuvent être au mieux réparties, dans un domaine qui est souvent complexe et coûteux, où les entreprises du secteur privé sont souvent en tête aussi bien du point de vue technique que pour l'analyse détaillée des répercussions. Toutefois, comme l'a fait observer un délégué asiatique, les pays de l'OCDE ont une vision très différente de la nature des frontières entre les secteurs public et privé.

Incitations

Les participants ont consacré un certain temps à l'examen des raisons pour lesquelles les enseignants résistent à l'introduction des nouvelles technologies mais ils ne se sont guère demandés si les incitations que sont les avancements de carrière, le prestige parmi les groupes de collègues, et la rémunération financière, les encouragent à adopter les technologies ou au contraire les en dissuadent. Une certaine résistance au changement peut être rationnelle et éventuellement juste, et dans certains cas est engendrée par une information insuffisante ou des délais trop courts pour débattre de cette question et la comprendre. Dans certains cas, toutefois, cette résistance a ses origines dans des "incitations perverses" inhérentes au fonctionnement des systèmes existants.

Principaux points examinés et conclusions

Il serait inapproprié de vouloir dégager des conclusions définitives d'un débat de trois jours au sujet d'un ensemble aussi divers de documents. Toutefois, cette rencontre a fait apparaître un certain nombre d'objectifs essentiels au sujet desquels les participants étaient largement d'accord.

Financer la mise en oeuvre

Les coûts les plus élevés et les problèmes les plus délicats qu'engendre l'application des technologies de l'information à l'apprentissage à vie sont d'ordre non pas technique mais humain. Ceux qui sont à l'origine du changement souvent n'ont pas compris cette réalité et de ce fait sous-estiment la nécessité de mener des campagnes de sensibilisation, d'intégrer la technologie dans le fonctionnement des systèmes d'enseignement, de repenser les structures d'organisation, et de donner des consignes pratiques et un soutien permanent aux personnes et aux établissements qui utilisent les technologies.

Améliorer l'évaluation

On s'est trop peu préoccupé d'évaluer les différentes façons d'envisager l'utilisation des technologies de l'information dans l'apprentissage, et dans de nombreux pays, les secteurs privé (où certaines technologies se trouvent beaucoup plus implantées) et public n'ont pas su procéder à des échanges de connaissances dans ce domaine.

Cette question a des aspects à la fois quantitatifs et qualitatifs. A l'heure actuelle, les informations quantitatives dont on dispose au sujet du degré d'utilisation des technologies de l'éducation et de la nature des technologies employées, ne suffisent pas pour permettre aux pays de faire des comparaisons ou aux chercheurs de repérer des exemples à étudier. Les questions qualitatives ne sont pas non plus faciles : on peut facilement sous-estimer les conséquences des différences culturelles, et il est également important d'éviter les modèles simplistes d'efficacité qui mettent l'accent davantage sur le coût, et sur les indicateurs directement mesurables, que sur les résultats plus généraux qui parfois n'apparaissent qu'à très long terme.

Les conséquences sociales et culturelles de l'apprentissage à vie sont aussi importantes que les conséquences économiques, et nous ne comprenons pas très bien ce que les apprenants adultes gagnent en suivant des apprentissages. La méthode des études de cas adoptée lors de la conférence de Philadelphie reste très efficace, et la mise au point d'une stratégie plus fine en vue d'entreprendre et de comparer les études de cas pourrait être une piste importante pour l'avenir.

Comprendre l'accès

Quand on adopte une technologie nouvelle, il importe de suivre et de passer en revue les conséquences qu'elle a pour ceux qui ont accès à l'apprentissage. Les technologies pour la plupart améliorent l'accès de certains et le réduisent pour d'autres, que les raisons de cette évolution tiennent aux personnes qui ont accès à la technologie elle-même ou à la façon dont cette technologie est utilisée. La mise au point de nouvelles technologies des communications pourrait permettre à de nombreux nouveaux groupes de population d'accéder à la formation tout en accentuant le préjudice de ceux pour lesquels elle est hors de portée pour des raisons financières, culturelles ou géographiques.

Sélectionner les technologies appropriées

Il n'existe pas de "meilleur" moyen d'appliquer la technologie à l'apprentissage. Chaque situation est différente et dans la plupart des cas il faudra conjuguer plusieurs technologies selon une formule qui variera en fonction du lieu, de la culture, de l'apprenant et du contexte institutionnel (entre autres facteurs). Parfois, l'association de certaines technologies se révélera contre toute attente la plus efficace, et il y aura des cas pour lesquels les manuels et les cours magistraux demeureront les outils pédagogiques les plus performants.

Du fait de la rapidité de l'évolution technique, les équipements deviennent rapidement obsolètes et les établissements d'enseignement travaillent souvent avec des technologies sensiblement moins performantes que celles qui donnent un "avantage comparatif". Il faut dans la budgétisation prévoir une actualisation constante, et les concepteurs des systèmes éducatifs devront peut-être s'intéresser plus aux technologies qui sont largement accessibles qu'aux possibilités offertes par les toutes dernières technologies. Lorsque de bons logiciels et de bons matériels existent sur le marché, il vaut sans doute mieux les utiliser que de concevoir des matériels spéciaux à des fins éducatives.

Mettre en place les infrastructures nécessaires

La question des infrastructures à mettre en place pour favoriser l'utilisation des technologies nouvelles dans la formation, et celle des meilleurs moyens possibles de le faire ont été abordées durant les débats, mais n'ont pas été examinées en profondeur. Dans certains pays, comme au Royaume-Uni et aux Etats-Unis, les pouvoirs publics ont pris d'importantes mesures pour mettre en place un système de communication à large bande entre les établissements d'enseignement, soit par voie de financement public, soit par un système de réglementation. Dans d'autres pays, cette question relève davantage du jeu des mécanismes du marché. Il est évident que le câblage des établissements scolaires et des établissements d'enseignement supérieur ne suffira pas pour garantir l'accès à la formation toute la vie durant. Il faut réfléchir davantage aux modalités et aux conditions requises pour que la population toute entière (qui est la cible de toute stratégie d'apprentissage à vie) puisse bénéficier d'un "service universel".

Améliorer les compétences et renforcer l'adhésion du personnel

Le succès des efforts de mise en valeur des ressources humaines dépend de façon décisive de la participation enthousiaste des intéressés. Il faudra pour cela aider ceux qui assument des tâches d'enseignement tels que les bénévoles, les surveillants, les membres des groupes pairs, et les dirigeants de collectivités ainsi que ceux qui exercent les fonctions proprement dites d'enseignant. Dans certains pays, il semble que les enseignants encourent réellement le risque d'être les laissés-pour-compte dans le développement du marché des technologies de l'information. Les marchés, plus vastes et plus riches, des systèmes de formation des entreprises privées, des formations dispensées par les sociétés de service et de conseil en informatique (où la "formation" à l'utilisation des logiciels est de plus en plus intégrée dans les produits eux-mêmes), et des jeux électroniques produits à l'échelle industrielle développent rapidement l'accès à la formation et l'acquisition de compétences dans la population. Les enseignants et les établissements d'enseignement seront peut-être de plus en plus amenés à travailler avec des élèves, des parents et des employeurs qui tous auront une meilleure connaissance des technologies qu'eux-mêmes. C'est l'occasion pour les enseignants d'améliorer leurs compétences et d'apprendre à vivre avec une conception moins hiérarchique de leur propre autorité, et pour les pouvoirs publics d'envisager la façon d'assurer l'accès à l'apprentissage de ceux qui ne constitueront jamais un marché rentable et dont l'exclusion de la société en général s'accentuera à mesure que d'autres vont continuer de progresser.

Apprendre les uns des autres

La diversité des pays de l'OCDE constitue un environnement où l'étude de l'impact des technologies sur l'apprentissage peut être riche d'enseignements. Toutefois, on ne saurait sous-estimer les difficultés rencontrées pour comparer les pratiques éducatives des différents pays et différentes régions. Ceux qui connaissent bien les technologies et qui suivent de près les débats internationaux sur l'enseignement et la formation peuvent aisément sous-estimer à quel point sont fondamentales les différences entre leurs cultures respectives, ce qui témoigne de grandes divergences et profondément ancrées, dans leur système de valeurs. Cette question est délicate car l'éducation est l'un des principaux moyens servant à transmettre et à préserver l'identité et la culture nationales.

Les technologies créent également un transfert de valeurs entre cultures, d'un genre que nous n'avions jamais connu auparavant. Dans la mesure où un marché sur lequel la concurrence joue librement marque une tendance naturelle à la convergence plutôt qu'à la diversification, il pourrait se faire, économies d'échelles obligent, qu'une grande partie du matériel pédagogique en arrive à se présenter sous une seule forme et dans une seule perspective culturelle, et à emprunter une langue unique. Cette solution pourrait être très commode pour ceux dont l'anglais est la langue maternelle mais elle serait extrêmement nuisible pour les pays considérés isolément, ainsi que du point de vue de la diversité culturelle dont la communauté mondiale tire profit.

La réunion de Philadelphie a néanmoins démontré d'une part tout ce que pouvaient apporter les comparaisons internationales, et d'autre part qu'il y avait lieu d'affiner les méthodologies. Nous devons être en mesure de mieux comprendre comment et pourquoi nous nous différencions, et de créer des instruments permettant d'observer les pratiques dans d'autres pays. Les études de cas les plus édifiantes ont peut-être été celles qui ont décrit avec force détails un segment donné de formation : elles consistaient à "raconter une histoire" dans le détail pour qu'il soit possible d'appréhender la réflexion qui sous-tend les orientations retenues. La mise au point de stratégies permettant de procéder à des observations pluri-culturelles de ce genre est un point important.

Remarque finale

A la fin de la table ronde de Philadelphie, j'ai présenté les grandes lignes de ce tour d'horizon. Plusieurs membres ont laissé entendre que cet exposé ressemblait à un jeu de patience dont les pièces seraient éparpillées et ont demandé que dans la version imprimée "les pièces du jeu de patience soient assemblées pour que nous puissions avoir une vision globale de la situation". D'une certaine façon, j'ai tenté dans cette section de répondre à ce souhait, mais d'une autre, cette demande est inopportune. En effet, nous sommes confrontés non pas à un jeu de patience mais à un écosystème en évolution constante. Nous devons observer, et surveiller, demeurant sans cesse réceptifs aux changements qui surviennent dans le système là où on ne s'y attendait pas et dans des aspects auxquels nous n'aurions pas pensé auparavant. Si nous avons tiré une leçon de la fin de l'ère industrielle, c'est bien que des solutions simples aux problèmes écologiques complexes peuvent avoir des effets totalement imprévus et catastrophiques.

En dépit des difficultés, nous avons toujours besoin de planifier, et d'apprendre les uns des autres. Le présent ouvrage est une contribution à ce processus, mais le monde nous surprendra toujours, et il se transforme au moment même où nous en parlons. A mesure que nous avançons, nous devons toujours nous rappeler qu'il y a encore bien des choses qui vont sans doute nous échapper. Nous serions peut-être bien avisés de ne pas oublier la remarque attribuée à un ministre britannique à la fin du XIXe siècle :

> "Le téléphone est peut-être valable aux Amériques, mais ici en Europe, nous avons tous les coursiers qu'il nous faut."

AUSTRALIA -- LEARNING TECHNOLOGIES IN THE TOURIST INDUSTRY

by
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This paper describes three applications of technology within the vocational education and training sector in Australia. The video conference network of the Department of Employment, Training and Further Education in South Australia is described. Briefer descriptions are provided of the Queensland College of Tourism and Hospitality/Australian Resorts satellite television project and also of a project by a private training provider called the Hotel Open Technology Education Link. These case studies provide a comparison of different approaches to the operation of infrastructure. The three projects vary from extensive design, ownership and operation of the infrastructure and associated equipment at one extreme to the use of a publicly available network and standard equipment at the other extreme. This raises the question of how an organisation determines what is an appropriate level of ownership for the operational level of the infrastructure required to conduct its education programmes.

The national context

Within Australia the prevailing attitude to the application of technology has always been positive, with rapid uptake of the improved facilities and appreciation of the benefits offered. A keen interest in seeking solutions that overcome the problems faced in various areas of activity has been displayed repeatedly over many years. This has been especially apparent in the introduction of communications technology largely due to the combination of a relatively small population in a large land mass with 18 million people in 7.7 million square kilometres. A comparison can be made by considering that Australia is approximately the same size as the United States, 50 per cent greater than Europe or 32 times that of the United Kingdom.

This positive attitude has a long history. Telegraph connections were completed between Sydney, Melbourne and Adelaide in 1858, a date which may not seem remarkable until considered with respect to the arrival of the first European settlers in Sydney in 1786 and in Adelaide in 1836. The desire for communications produced the facility extending 1 500 kilometres just twenty years after the settlement in Adelaide. Similarly, the first Australian telephone line was installed just two years after the patents by Bell and Gray in 1876. The short time scale from invention to Australian use also occurred in other fields of technology, for example the first X-ray was used in Adelaide in 1896 after its discovery by Roentgen in 1895.

Technology uptake in Australian has not only been rapid in terms of introduction after invention but has also been widespread within the society and on a comparatively large scale. For example, Australia's information technology sector produced revenue of A$14.6 billion in 1995, a 10 per cent growth from the previous year, and greater than the worldwide average growth of 7.5 per cent. It is predicted that one in two Australian homes will have a personal computer by the year 2000, which is double the current level of home computer ownership. Residential ownership of telephone access in Australia is 95 per cent, making it the second highest worldwide.

An interest and willingness by Australians to accommodate new technologies in their lives has been so evident that the Australian take-up rate of new technologies (and an international perception of it) is cited as one of the nation's strengths in the emerging industry associated with multimedia production (Coopers and Lybrand, 1995, p. 53).

Given this Australian attitude to technology, it is not surprising that the application of technology to education has also received considerable attention. Recent reports commissioned by the National Board of Employment, Education and Training have been focused on the increasing convergence of technology and the implications for education and training (National Board of Employment, Education and Training, 1995 and forthcoming).

The educational infrastructure for the education of adults in Australia consists of three sectors; vocational education and training (VET) which also encompasses the technical and further education (TAFE) institutions; the higher education sector consisting of 36 universities; and the adult and community education sector. Australian educational institutions operate within an environment which has undergone substantial change in recent years and this has been accompanied by an increasing need to provide new modes of delivery.

The current structure of the higher education sector resulted from a major reorganisation of the sector in 1988 (Commonwealth of Australia, 1988). Significant restructuring took place with accompanying institutional amalgamations, principally involving former Colleges of Advanced Education and Institutes of Technology. As a result, all of these institutions were classified as universities and compete for funding supplied by the Commonwealth Government although they are autonomous bodies operating under State legislation.

The Employment and Skills Formation Council in its report "Converging Technologies, Work and Learning" commented that changing circumstances were leading universities to consider non-standard modes of delivery and cited as examples of the influences likely to encourage greater use of technology:

- the rising demand for continuing professional education;
- the need to generate revenue through provision of courses beyond government funded student places;
- the involvement of universities themselves in research and development of new technologies;
- demands rising from open learning;
- the upgrading of distance education techniques;
- the export of education services;
- quality assurance rankings;

- the provision of grants for the production of multimedia courseware; and
- the availability of capital funds for technological infrastructure;

The report from the National Board of Employment, Education and Training (forthcoming) comments that "technologies have made little impact on the organisation of teaching and learning services in the majority of universities". The most recent release of grant funding by the Committee for the Advancement of University Teaching indicates that there is strong support for projects which investigate the application of new technology to teaching. Such projects constituted a majority of 107 projects in 1996.

In 1992 the Commonwealth Government and State/Territory Governments agreed to the establishment of a new national vocational education and training system, with national policy, priorities and strategies determined by a joint Ministerial Council for Education, Employment, Training and Youth Affairs. The national strategy included the formation of the Australian National Training Authority which began operation on January 1, 1994. The delivery of vocational education and training remains a responsibility of the States and Territories with the majority of the educational delivery conducted through government administered Technical and Further Education (TAFE) Colleges or Institutes.

The tourism and hospitality industry

An example of the need to provide new forms of vocational education and training is evident within the tourism and hospitality industry in Australia. This industry has experienced exceptional growth in the last decade. Tourism now accounts for a greater percentage of export earnings than Australia's traditional export commodities in mining and agriculture.

Although Australian international visitor arrivals represent only 0.5 per cent of total international visitor arrivals in all countries (and is unlikely to improve due to the long distance to Australia), the growth of Australian arrivals was twice the international growth rate in the latter half of the 1980s. From 1984 to 1994 arrival numbers increased from 1 million to over 3 million (Castles, 1995).

The need to provide education and training within this industry forms a link between the three case studies considered below. In particular, the increased importance of the tourism and hospitality industry and an accompanying increase in standards of service delivery is reflected in projects which seek to provide education training to industry participants at or near their place of employment.

Case 1 -- Video conferencing in the Department for Employment, Training and Further Education, South Australia

The State of South Australia has an area of just under one million square kilometres with a population of approximately 1.5 million people. Such statistics imply a low population density, but in fact the State is highly urbanised in the sense that the majority of the population do not live in rural areas. Seventy five percent of the State's population live within the capital city Adelaide and its suburban districts with another 10 per cent in other urban locations.

The South Australian Department for Employment, Training and Further Education (DETAFE) provides tertiary education through ten institutes of TAFE. The institutes operate a total of

61 campuses spread throughout the State of South Australia. These locations offer over 300 courses covering a large range of post-secondary education up to but not including Degree courses, with qualifications formerly at the diploma, associate diploma, advanced certificate and certificate levels (these qualification classifications are now being reconstructed within the Australian Vocational Training System). Accreditation of courses is conducted at a State level with inclusion of all courses into the National Register.

As an example of one of the DETAFE institutes, the Murray Institute of TAFE operates seven campuses at Gawler, Nuriootpa, Clare, Waikerie, Berri, Renmark and Loxton. These locations vary in their situation from the City of Gawler, which is adjacent to the State's metropolitan capital, to distant towns such as Waikerie and Berri which service local agricultural and recreational areas.

This spread of locations raises problems in encouraging student enrolments in locations where it is not economical to offer courses through traditional methods. Minimum enrolments of 15 students are required for any course and throughout the region covered by Murray Institute the distribution of the population meant that this was often not possible. In occasional circumstances potential student demand for a particular subject may exist, but the relevant expertise is not available locally.

In the late 1980s consideration was given to the use of video conferencing as a means of aggregating student numbers across several locations in order to meet the enrolment requirements for conducting courses. The initial video conferencing trial was conducted in 1990 between Adelaide, Barossa Valley and Clare, 140 kms north of Adelaide. The initial network was established with Compressions Labs (CLI) equipment connected via 384Kbps ISDN lines.

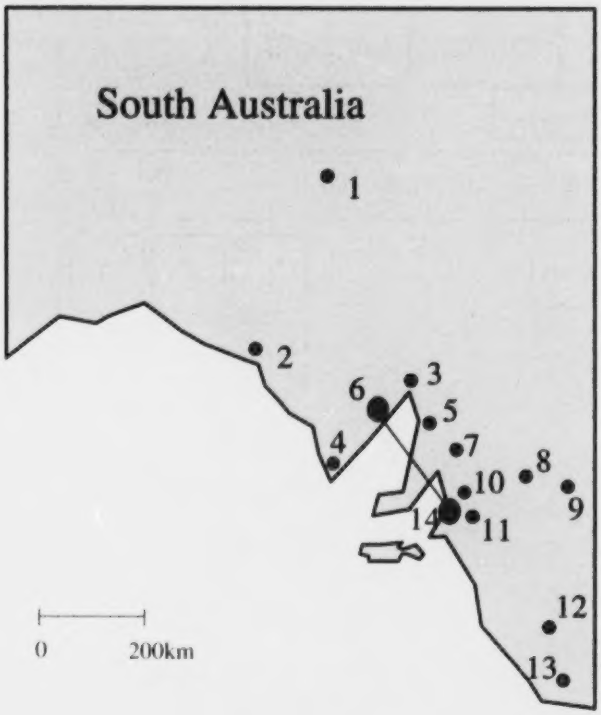
The initial network operated successfully and achieved the aims of the trial but the requirement for high speed ISDN lines and the associated cost was a limiting factor in the expansion of the network. However it became apparent that the room designs employed by DETAFE were effective in ensuring that lecturers and students were able to operate efficiently, with accompanying benefits to both students and the institutes. A desire for the network to be expanded led to consideration of alternative equipment and eventually the installation of Picturetel equipment which provided effective picture quality over 128Kbps ISDN lines through data compression technology.

The current network consists of 19 sites (see Figure 1), each of which is equipped with either Picturetel 4000E or 4000EX units capable of operating H.320 and SG3 protocols. The location of the sites are determined by the autonomous institutes, with most institutes having sites at several of their campus locations. All connections within the network are operated as 128K ISDN connections. The decision of whether to use dial-in connection or semi-permanent connection is determined for each link by the level of activity across that link.

The network has two Picturetel M8000 bridges, one located in Adelaide and the other in Whyalla. Individual sites are connected to whichever of these bridges is closer.

Within the DETAFE network a video conference room is usually equipped with two cameras, three large monitor screens, the lecturer's operating console which includes an AMX touch screen control panel and smaller monitors built into a special lectern, Canon video visualiser for graphical display, video cassette recorder for transmitting pre-recorded video and student desks each with a separate microphone.

Figure 1



1	Coober Pedy
2	Ceduna
3	Pt Augusta
4	Pt Lincoln
5	Pt Pirie
6	Whyalla (Bridge)
7	Clare
8	Waikerie
9	Berri
10	Barossa
11	Mt Barker
12	Naracoorte
13	Mt Gambier
14	Adelaide region (Adelaide(Bridge), Elizabeth, Gawler, Marleston, Noarlunga, Regency)

The facilities at each location have been designed to ensure that as far as practicable, the operation of the video conferencing equipment and the conduct of a session require minimal expertise.

Control of the equipment is managed from the AMX touch screen located within the specially constructed lectern. This screen replaces the equipment manufacturer's standard keypad which is normally used to control the operations. With the touch screen facility the lecturer is able to operate all aspects of the video conference operation from initial power-up to control of remote cameras.

Figure 2 illustrates the touch screen presentation at the time of call setup. The same screen would also be used by students at the remote sites who are responsible for establishing the connection of their site into the video conference. The simplicity of operation has enabled the system to operate efficiently without the need for full time technical support at all sites.

During the session the lecturer uses the touch screen to control various aspects of the presentation, switching easily between a variety of video inputs as shown in Figure 3.

The VCR/Class/Graphics/ME section provides a simple method of selecting the various video sources and the highlighting of the selection re-assures the operator of the current source that is in use. Microphone control and volume settings and camera direction, focus and zooming are controlled from the same screen. The presentation of the essential information in a clear and unambiguous mode assists relatively novice operators who may be either lecturers or the remote students to operate the equipment with confidence.

Figure 2 **Call setup**

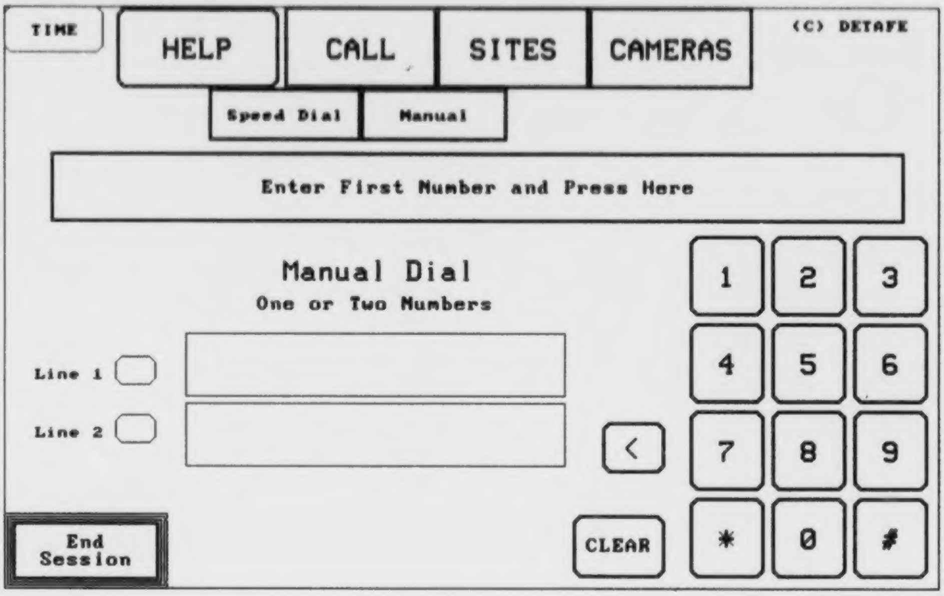
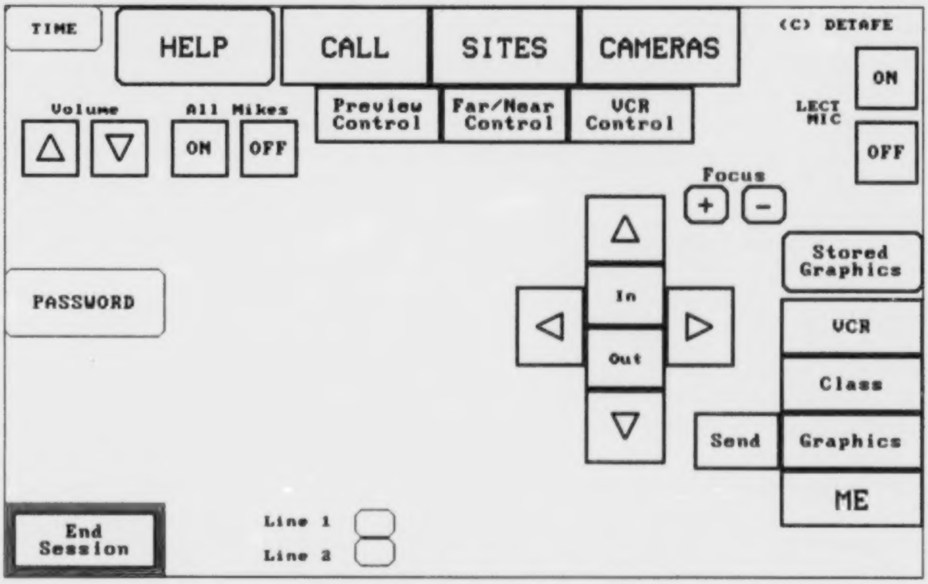

TIME
HELP
CALL
SITES
CAMERAS
(C) DETAFE
Speed Dial
Manual
Enter First Number and Press Here
Manual Dial
One or Two Numbers
Line 1
Line 2
<
CLEAR
1
2
3
4
5
6
7
8
9
*
0
#
End Session

Figure 3 **Camera control**


TIME
HELP
CALL
SITES
CAMERAS
(C) DETAFE
Volume
All Mikes
ON
OFF
Preview Control
Far/Near Control
VCR Control
LECT MIC
ON
OFF
Focus
+
-
In
Out
Stored Graphics
VCR
Class
Send
Graphics
ME
PASSWORD
End Session
Line 1
Line 2

It is also possible for the lecturer to control the operation of both local and remote sites through the far/near control screen (Figure 4). Again the terminology of the control screen and the range of functions is presented in a way that enables inexperienced operators to understand the options and manage the facilities.

By representing all of the operations through the specially designed AMX touch screen formats, the network operates with a minimum of technical support. To ensure that immediate contact can be made in the event of problems, each room is equipped with a telephone that is a direct exchange connection (*i.e.* not switched through a PABX). This ensures that easy contact with remote sites is possible at all times and also provides an immediate contact mechanism from a site experiencing problems to the technical support located at the major site in Adelaide. Each site also has a non-PABX telephone line with a modem connected to the AMX control mechanism enabling a technician to remotely configure the system when a problem prohibits the establishment of the ISDN video conference connection.

Figure 4 **Far site/near site control**

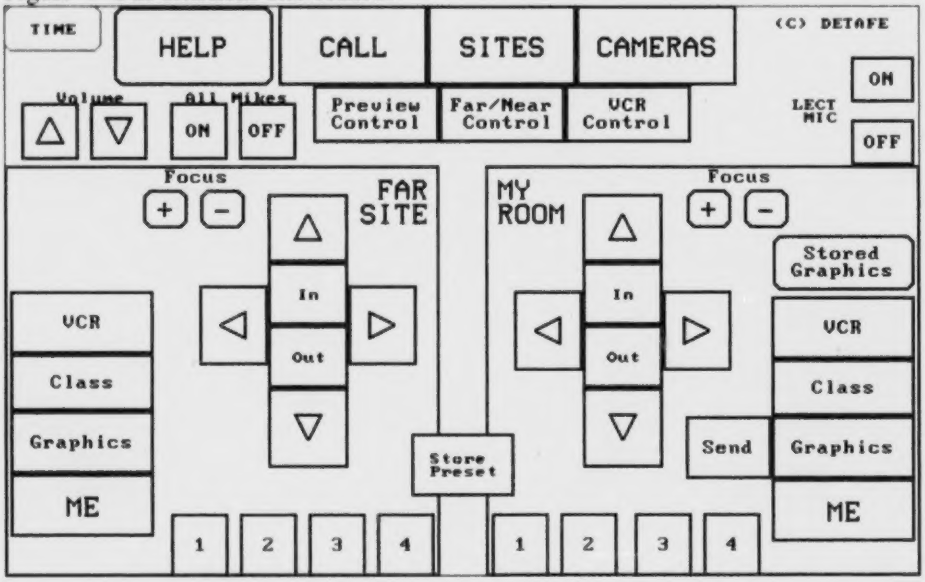
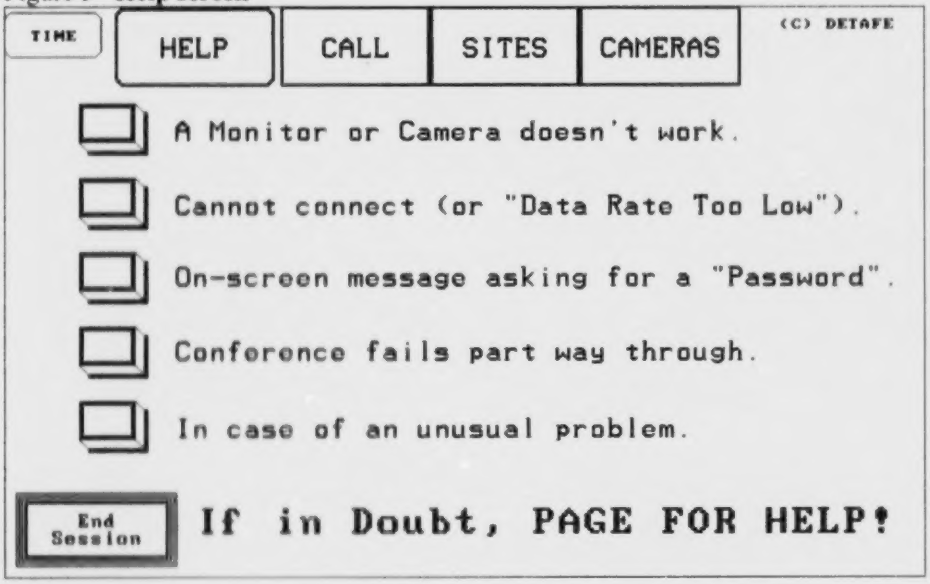

TIME
HELP
CALL
SITES
CAMERAS
(C) DETAFE
Volume
All Mikes
ON
OFF
Preview Control
Far/Near Control
VCR Control
LECT MIC
ON
OFF
Focus
+
-
FAR SITE
In
Out
VCR
Class
Graphics
ME
1
2
3
4
Store Preset
MY ROOM
Focus
+
-
In
Out
Stored Graphics
VCR
Class
Send
Graphics
ME
1
2
3
4

Figure 5 **Help screen**


TIME
HELP
CALL
SITES
CAMERAS
(C) DETAFE
End Session

☐ A Monitor or Camera doesn't work.

☐ Cannot connect (or "Data Rate Too Low").

☐ On-screen message asking for a "Password".

☐ Conference fails part way through.

☐ In case of an unusual problem.

If in Doubt, PAGE FOR HELP!

It is expected that the lecturer is able to recognise when a problem exists and that if it cannot be resolved quickly the remote technician is immediately available. Again the AMX screen provides the mechanism for presenting help to the lecturer or remote students (Figure 5).

Typical costs per site are in the order of A$120 000 for the video conferencing equipment with additional variable costs depending on the amount of lighting and room acoustic modifications needed to convert the room from its previous use to that of a video conference studio.

Level of use

In 1995, the locations were in use for a total of 12 500 hours with the most frequently used room having a usage figure of 1 500 hours. The figure for total hours includes sessions with multiple locations, hence this is somewhat larger than the total hours of class usage which was almost 6 000 hours in 1995. The network is used predominantly for educational use with 95 per cent of the transmission being classes.

The high level of use has enabled several of the network locations to have the ISDN connection established as a semi permanent circuit (SPC) rather than the initial dial-up ISDN connection. Above a certain level of use, the SPC connection is more economic than dial-up in terms of the total cost of the connection per annum compared to the number of hours of transmission, *i.e.* the cost per hour becomes less expensive than the A$45/hour for dial-up connections. As an example, the Clare location is 120 km from the Adelaide bridge and is typically used for 1 500 hours per annum. An ISDN SPC line over that distance costs A$17 500 per annum resulting in an effective cost of approximately A$12/hour for that location. Similarly the Port Lincoln location, 250km from its bridge, is used for approximately 1 000 hours per annum with an SPC line cost of A$20 000.

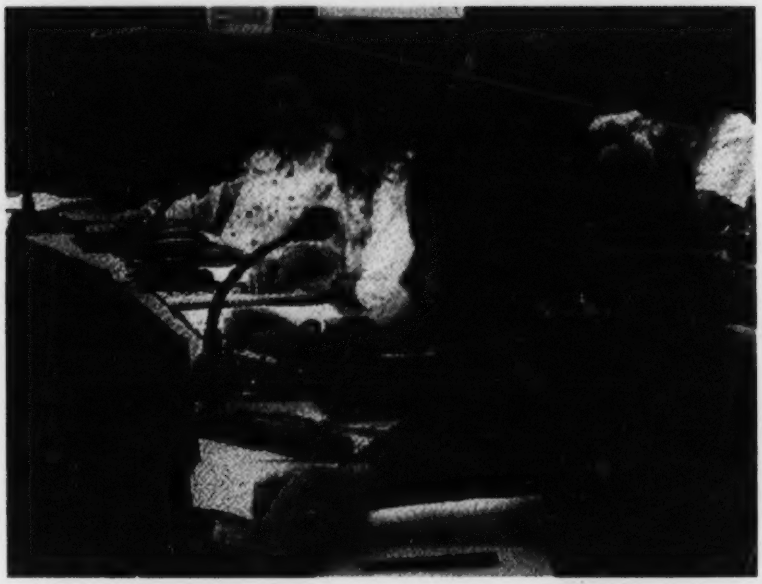
Effects on students and lecturers

Much of the extensive consideration of room design and equipment modification has been undertaken to ensure that lecturers can operate initially with little modification of their usual teaching methods. The use of multiple cameras and individual student microphones assists in the recreation of many of the "norms" of a face to face classroom. Student control of their individual microphones (Figure 6) enables students to determine when they will be heard. This provides students with an opportunity to interact with neighbours in a manner analogous to traditional classrooms, *i.e.* it needs not attract the attention of the whole class and it also eliminates problems that are encountered with voice activated video switching between multiple sites.

The individual microphones also provide a higher quality audio transmission than is usually experienced with microphones intended to pick up sounds from the whole of the group within a room. This assists in ensuring a better impression of the quality of the session, as it is generally agreed that the participants' sense of quality is often more dependent on the audio transmission than on the video images.

This environment allows lecturers to begin teaching through video conferencing with similar class sessions to traditional operation and assumes that it will be an easier task to have lecturers use a medium that is new to them by adapting slightly rather than engaging in a major restructure of their styles and operations. This is particularly relevant in the vocational education sector where the use of part-time lecturers with a full time occupation or profession is common.

Figure 6 **Individual microphones**



Although the initial introduction of lecturers to the video conferencing medium can be done with a minimal change to their teaching style, the lecturers are faced with a strong imperative to re-think aspects of their course. Namely, the likelihood that, due to costs, a course offered through video conferencing will be limited to lower hours of contact than a traditional classroom. Typically, the reduction is half of the normal contact time. This leads to a re-evaluation of the structure of the course and consideration of more effective means to convey a concept than might be the case otherwise.

The reduction in hours is also a major impetus for the mechanisms which enable rapid assistance to be provided remotely. The lecturers are already under time and therefore any delays in rectifying problems would make the system unacceptable to the lecturers.

Several aspects of student behaviour and attitude associated with the video conference sessions have been reported. Multiple site sessions are often conducted with the lecturer and a local class communicating with remote sites where only students are present. It has been noted that the remote students are often pro-active in raising questions and initiating discussion on the session's topics. In one instance a lecturer reported that the local students displayed a degree of unease with the interactions that came from remote sites. The local students were more comfortable with a passive approach that allowed the lecturer to proceed through a presentation without interruption.

In this case the remote site was sufficiently close so that the lecturer was able to travel to the remote site on one occasion and conduct the session "the other way around", *i.e.* with the former remote students becoming the local students and vice versa. On that occasion, the reaction of the students was also reversed with the previously local students now seeking to participate in the interaction of the lecture.

Increased student participation through the use of video conferencing has also been reported through gains in the number of students completing their qualifications. At one of the institutes located in a rural region the number of students graduating increased by 500 per cent in the first two years of video conference operations.

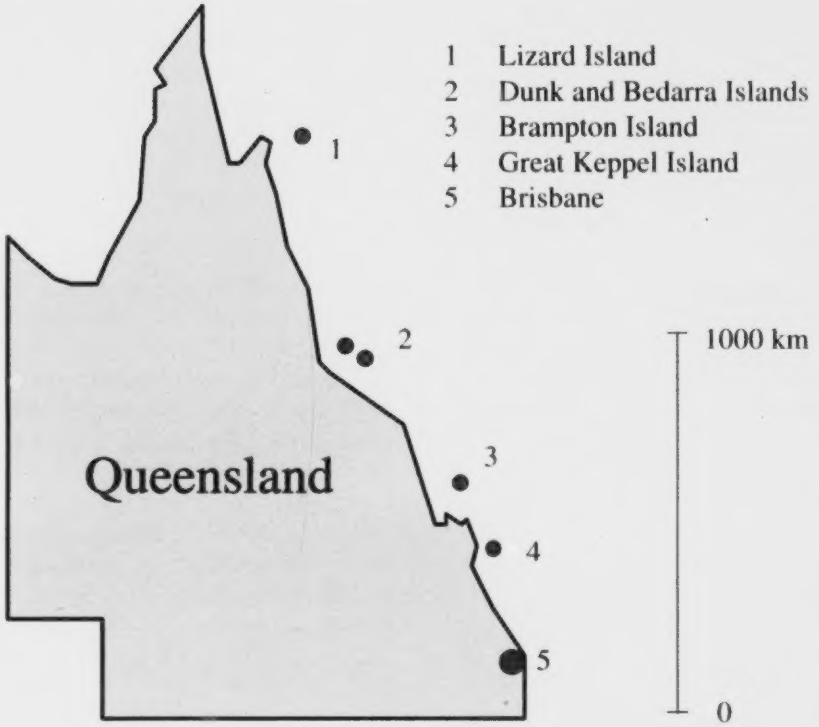
Better student results were also reported when a comparison of end of year exam results was made between students accessing courses through video conferencing and students in face-to-face classes. Students in video conference classes had a slightly higher average score than the face-to-face students.

Case 2 -- Queensland College of Tourism and Hospitality/Australian resorts

In Queensland, a northern State of Australia, the Brisbane based Southbank Institute of TAFE includes a College of Tourism and Hospitality (COTAH). COTAH had previously conducted several training courses for the Australian Resorts organisation, a subsidiary of QANTAS Airlines. Australian Resorts owns and operates several of the holiday resort facilities located on islands within Australia's Great Barrier Reef (see Figure 7).

Prior to 1993, COTAH training for employees at the resort was delivered through face to face sessions which involved bringing to one of the islands the COTAH staff from Brisbane and the Australian Resorts' staff from other islands. In 1993, Australian Resorts and COTAH initiated a project to use satellite television as a medium to allow the staff to be trained without leaving their place of employment.

Figure 7 **Receiver locations (1-4)**



This was feasible because several of the necessary components were already in place. For some years Queensland had been using satellite technology as a means of delivering television to many of its "outback" locations, *i.e.* communities in the western and northern parts of the State. Satellite television usage had begun in 1987 and the Queensland government had established a television operations unit, TSN11, within its Department of Administrative Services.

TSN11 used satellite narrowcast technology and conformed to the then Australian satellite broadcast standard which had been chosen as B-Mac. The TSN11 unit had been developed from a video production studio which had operated within the Southbank Institute of TAFE building in Brisbane. Hence, much of the infrastructure needed for the COTAH/Australian Resorts project was already in place, except for the necessary receiver equipment which Australian Resorts installed at its resort island locations.

The training programme was initiated because Australian Resorts needed to enable its employees to gain convenient access to the accredited TAFE courses in tourism and hospitality based on the nationally established competency levels in industry. The project included the development of training modules designed specifically for satellite delivery. The modules covered the areas of:

- bar service;
- housekeeping;
- landscaping;
- kitchen attending;
- front office;
- restaurant service;
- leisure.

Delivery of the modules included a mix of print materials, audio tapes, pre-recorded video and satellite transmissions. Three hundred Australian Resorts' employees participated in the training programme. A computer managed learning programme for assessment was produced to allow assessment of the theory components through sets of random questions, with a requisite of an 85 per cent score for successful completion of the module.

The satellite transmission sessions were operated in conjunction with simultaneous telephone conference of the students. Hence the students received video/audio via the satellite equipment and were able to interact vocally via the telephone. The teaching staff were advised to construct these sessions in a similar manner to traditional classroom activity, but over the course of the project this was modified as a result of student feedback, with the satellite television sessions containing more highly produced video productions than the informal interactive sessions that had been planned.

One of the types of interaction that was particularly difficult to sustain was the cross audience interaction in the sense that the conversation tended to remain as a lecturer/student interaction with little evidence of student-student interaction between different student locations.

Following the use of the satellite transmissions for staff training, Australian Resorts managers have reported that staff turnover has reduced from 270 per cent down to 110 per cent. Another benefit that has been recognised is the ability for resort staff to gain skills in areas other than their initial employment area, for example cross-skilling can occur within the report by providing hospitality training in bar and restaurant services to staff employed in other areas. This enables the resorts to ensure that they have staff available to call upon during high demand periods.

Case 3 -- Hotel Open Technology Education Link

Online services have experienced rapid growth in Australia in the last five years. Australia is amongst the top five countries in terms of Internet traffic and has been able to build upon well established high standard communication networks. Two factors have contributed to relatively easy access to online services -- the high incidence of residential telephone access and national networks for both data and voice that allow simple operation from the perspective of the end user.

The Blue Mountains International Hotel Management School is situated at Leura in the Blue Mountains just to the west of Sydney, New South Wales. The school is conducted as a fully residential operation, essentially a hotel with its students as the guests. The school has achieved a high degree of success through this mode of operation but its director became aware of a perceived need within the hotel industry to provide formal training to existing employees.

Although many employees within the industry receive in-house training, this is often not officially recognised and accredited between hotel chains. Hence, it was recognised that there existed an opportunity to have an accredited course that could be delivered across the hospitality industry using an open learning philosophy. The course was developed particularly for experienced employees within the industry with management responsibilities.

A needs assessment by the industry indicated that a suitable course should combine finance, marketing, human resource management, operations and logistics. This was then developed with input from hotel chains and academic faculty and is delivered to employees who have a minimum of four years management experience and manage more than four staff. Enrolments have generally come from industry employees who have not studied for some time and often did no formal study beyond school.

To enable participants to undertake the course via open learning methods, the print material was also presented as an interactive computer resource with added benefits of searching, hot links, glossary functions and student annotation entries. Self test facilities were included in the computerised resource with assistance and explanation available.

Given that the participants were widely dispersed, the course also included the use of an online resource which enabled peer-peer interaction, tutor interaction and contact with academics responsible for the course design and operation. The online service also provided access to text databases including news services and contemporary articles from a hospitality industry publisher.

When considering the options for the provision of the online service to students, the HOTEL developers chose to use an existing online service which was available nationally through Australia's public X25 data network. This ensured that students were able to link to the HOTEL activities from any telephone and incur only the cost of a local untimed call on the originating telephone subscribers account. Although the cost of using the online service included time based charges, these could be efficiently controlled and reported to the individual student users.

The prior existence of a service that matched the needs of HOTEL enabled the project to quickly establish its individual aspects within the online service without having to engage staff to support students in the technical aspects or to design access infrastructure.

Comparison of the three infrastructure models

The case studies described above illustrate that the level of involvement in the design and operation of the communications infrastructure to support an educational project can vary considerably. The South Australian DETAFE video conference network uses the ISDN communications lines of a common carrier but the design, ownership and operation of the video conferencing network lies within the organisation itself. DETAFE has minimised the level of support that is required to operate and maintain the network and to conduct video conference sessions through the use of simple and clear conference control facilities which are presented on the AMX touch screens.

The COTAH/Australian Resorts project was able to use the infrastructure that had been previously established by a State wide agency. It was necessary to undertake the installation of some additional equipment such as the receiver equipment at the target locations but this was also done using the expertise of the TSN11 unit. The infrastructure in this case had grown from a single agency facility (the original video studio) and merged with the state-wide satellite facility to create a whole of government utility which could be utilised by many agencies according to need. Its existence provided a readily available solution to the communication needs of the project.

The HOTEL project used an existing commercial service which itself had been built through the availability of a public network and hence ensured that the HOTEL requirements were provided within a commercially competitive environment. The operation and maintenance of the facility remained the province of the commercial provider leaving the educators responsible for only the content of the HOTEL forum.

In each of these case studies the project managers were able to choose an infrastructure solution that met their needs and gave the desired level of control over the educational objectives of the project. Yet the level of involvement in the operation of the infrastructure varies from case to case. From this arises the question of how an organisation determines the most appropriate solution for its infrastructure. This is separate from the question of which technology might be used and acknowledges that for many forms of technology, a variety of operational structures are possible, spanning the spectrum from a complete build, own and operate scenario to the purchase of services on a needs basis with no ownership of the infrastructure.

An organisation is likely to determine the appropriate method of operation of its infrastructure by considering the factors which influence the level of control that it requires and also those factors which affect the level of resourcing necessary to develop, operate, and maintain the services.

The factors which have influenced the case studies described above are:

- the availability of an existing facility;

- the flexibility of the communications solution to meet changing requirements;
- the scale of the required infrastructure;
- the ability to customise a technology to the specific needs of the organisation;
- a cost-benefit analysis for the different options.

As the solution moves through the range from the ownership option to the service purchase option, the aspects on which the organisation might focus also change. Associated with this variation in focus is the identification of what the organisation believes to be the most crucial aspects of the educational/technological system under consideration.

Such an analysis can be seen in the current Australian project to create a national service to provide online facilities in all sectors of education. Education Network Australia (EdNA) was proposed and accepted by the Ministerial Council for Education, Employment, Training and Youth Affairs (MCEETYA) at its meeting in May 1995. This joint council of the Federal and State/Territory governments agreed to the proposal that the establishment of the network required several components: end user equipment, network services and content.

Although the initial work has involved activity in all three areas, the focus has been on ensuring that the ongoing management of the network, and in particular the content which it provides, is suitably structured to cater for future developments. To achieve this MCEETYA chose to use the Open Learning Technology Corporation Limited (OLTC) as the governing body for EdNA.

OLTC itself is a unique organisation in the sense that it operates across all sectors of education on a national scale with an emphasis on the use of open learning. It is a company, jointly owned by all the Ministers of Education, and hence provided an existing structure with the required level of collaboration to undertake the governance role for EdNA.

The focus of attention in this role has become the governance of the mechanisms which will ensure that educational content is readily available from the EdNA service. This entails several aspects of the information delivery process, from the fostering of content development to the design of services which enable clients to find the content which satisfies their educational needs.

The recognition that the education and training community itself needs to have a strong role in the supply and selection of content is indicative of the importance placed upon this aspect. Although the choice of technologies and operation of the technological infrastructure which will provide the delivery systems for this content are also important factors in the EdNA design, the crucial importance of content has been recognised early in the EdNA process. Hence the opportunity exists to ensure that the technological infrastructure is designed to support the content and enable future development of content in the most effective manner.

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CANADA -- TECHNOLOGY IN ADULT SECOND LANGUAGE TRAINING

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The national context

Because of Canada's vast land mass, its relatively small, disperse population and its northern climate, educators have been quick to seize opportunities offered by technologies in reducing educational barriers including this newest addition to the mix, information technologies. Overcoming geographic distances in providing education for all Canadians has challenged provincial and territorial governments and it is in distance education that information technologies have played the most significant role. However, with the growing use of computer labs and with increasing interest in the use of the Internet and the World Wide Web, both for their interactive capacities and their vast information resources, the distinctions between resources and approaches used in the traditional classroom and those employed in distance education are diminishing. This brief introduction will touch on a few of the major trends and innovations in the use of technology in adult education in Canada.

The use of **radio** as a support for formal and informal education, though initially limited, began in Canada as early as the 1930s. By the 1960s television was becoming more available and educators were very excited about the anticipated opportunities. The national broadcast service, the Canadian Broadcasting Corporation (CBC), offered provincial departments of education up to five hours each week for educational purposes. However, by the early 1980s the growing availability of VCRs and the emergence of provincial education broadcast undertakings led to the discontinuance of the national service.

Canada continues to make wide use of **television** in support of adult learning. At this point five provinces have educational broadcast operations[1] and the four Atlantic provinces have access to approximately twenty hours of broadcast time made available by a commercial station. However, during this year one of the provincial television operations, ACCESS Alberta, was privatized and it appears that with provincial budget cuts there will be pressure for others to follow suit. Although the government of Alberta will continue to pay ACCESS to produce a number of adult and youth education programmes, the new owners will have to find additional revenue to remain on air. This they intend to do by working closely with training and education institutions and in soliciting advertising. In addition, a national education service distributed through cable systems may be on the horizon. In January of 1996, the Canadian Radio and Television Commission will receive applications for new specialty channels. It is expected there will be several applications for a national educational service and that at least one will be successful.

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[1] Radio Quebec, TV Ontario, Saskatchewan Communications Network, ACCESS Alberta and the Knowledge Network of British Columbia.

Canada has been highly innovative in the use of television to support education. One of the three case studies outlined in this document deals with a novel use of closed captioning of TV programmes which was initially intended for use by the deaf. The case study is based on a pilot project which carefully assesses the use of captioning in second language programmes. The results are encouraging and with the mandatory addition of built in, captioning decoders, it is likely that use of this technology in support of a host of literacy based programmes will become widespread.

In all provinces there are distance education networks employing **telephone transmission** services to enable the use of one or more of interactive audio, audiograhpics and in some cases video. These networks could, perhaps, be viewed as the work horses of the technology based distance education programmes and are used primarily for adults who are undertaking post secondary training at a distance. For instance twenty universities in the country offer a total of ninety-three full degrees (Bachelors and Masters Levels) using distance technologies such as these. Some advances are also being made in the use of compressed video technology for instruction. Queen's University for instance offers an MBA nationally using compressed video as the primary technology support. College de L'Acadie similarly offers complete college level programmes throughout French speaking Nova Scotia using this technology. In some cases these networks are controlled by a university or consortium of universities and in others they are operated by a provincial agency. At this point there are no privately operated networks used for general adult education or training.

The cost of communication transmission (telephone and television) for educational purposes has been a recurring issue in Canada. In Nova Scotia, a special education tariff has been established and in New Brunswick, although not in the form of a new tariff, transmission costs were significantly reduced by the telephone company. The issue of appropriate tariffs is critical to the provision of timely and relevant learning opportunities. This has been recognised for a number of years in Canada as well as in a number of other countries. In recent years, particularly with the recognition of the importance of access to the information highway, the Canadian government has undertaken a number of activities to bring resolution to this matter. Recently Canada's telecommunications regulator recommended that telephone companies establish a tariff designed specifically for education and health users. This tariff is presently being considered. Since it is common for general adult programmes to be available through these telephone based networks, the issue of the tariff is equally important to those offering adult learning opportunities.

Use of **audiographics** technologies is quite common in the programme offerings of these telephone based distance education networks. At this point, there are three audiographics formats in general use in Canada. These formats are Optel, Vis-a-Vis and SMART 2000. Each of these allows for the interactive display and manipulation of computer information and handwritten annotations between parties at all sites. As the name implies audio interaction accompanies the visual exchange. High resolution images are delivered to all connected locations, with all participants able to annotate, highlight and add to images and information being displayed. The images referred to can be still video frames, scanned images or instructor prepared diagrams. Each of the three companies concerned has also worked with codec suppliers to integrate their product with compressed motion video thus representing the convergence of the three technologies touted by the champions of the "information highway".

Another major trend is the use of stand alone computer mediated instruction both for adult basic education and for work place training. In two of the case studies outlined in this report there are examples of the use of computer software in adult programmes where instructors used off-the-shelf or third party software and through a significant planning effort integrated these packages into learning programmes suitable for the anticipated client learner. In all provinces one sees examples of the use of computer based instruction.

There are numerous examples in Canada of what are generally referred to as **"integrated learning systems"** (ILS). In general, the ILS approach is a combination of computer managed instruction in that printed texts are still used within the overall programme and computer assisted instruction in that the students use the computer programmes for direct instruction. There are approximately five companies marketing such systems in Canada and they offer a variety of print and computer resources to support primary to secondary programmes as well as adult upgrading and training. In most cases the ILS companies are able to offer a customizing service which means that they will adapt their computer software to incorporate regional course content needs. However, the basic instructional style remains constant. An attractive aspect of the ILS approach is its comprehensiveness. In fact, if an institution wishes, it is possible to purchase a combination of hardware, software, training and service. The most common use of ILS programmes for adult is in upgrading basic education. In some cases the facilities and resources are shared with a day school. In other cases there are training centres for adults only. ILS programmes are often used by adults as a preparation for workplace training. Uses of ILS range from a single work station to a networked lab and in some cases networked labs in separate communities are connected to a central server. There are several experiments now taking place in cities in several Western Provinces which provide ILS resources on-line to homes.

While there are Canadian branches of the three major ILS companies, all are American owned. There are, however, interesting advances in computer based programme development in Canada which have the ILS attributes. This activity had its origin in the Western Provinces but now involves the Atlantic region as well. The first project focused on Mathematics and several hundreds of thousands of dollars were spent in developing what is considered to be a state of the art, self contained highly interactive CDROM based programme which essentially provides an all inclusive, year long course. This programme was designed for use by school age students as well as adults. Work is now progressing on similar CDROM based science courses. What distinguishes these efforts from other computer aided programmes is the opportunity for students to explore a variety of possible solutions to problems. The team has discovered methods of having the course very open-ended and yet still manageable by a student on his or her own. It is now clear that this development will continue to require the joint support of several provinces. The practice is to have the consortium of provinces team with a university department and private businesses which can provide initial funding and production support in return for marketing rights to the product. The long term goal of this project is to make available an entire electronic version of a highschool programme which would be available for adult upgrading throughout Canada.

One of the developments which has made the computer aided programmes rather inviting is the growth of **Community Schools**, often equipped with computer labs, which serve the primary and secondary needs during the day and adult education and training needs during the evening. This change was probably pushed in part by the distance education networks which needed to have community sites for teleconferences and other group learning activities related to their programmes. In at least two provinces, the departments of education have made funding for computers contingent upon their availability for evening use for adults. In other provinces this dual use is strongly encouraged. There are also some examples of partnerships between a department of education and a private business consortium which results in a school being built and owned by a private company which can offer programmes for adults. The advantage is that it is easier for the private group to provide and keep up to date education technologies. This trend towards broader access to schools will continue to be stretched by such programmes as the Community Access Programme described below.

Another significant technological development in Canada which raises new possibilities for adult educators is the growing access to the **Internet** by households. In Canada this growth is being hastened by the spread of the Community Net or Free Net movement. Although in Canada the term Community Net and Free Net are somewhat interchangeable, Community Net is becoming more commonly used. In both cases these names denote not-for-profit community based organizations which offer Internet services at as low a cost as possible. In the case of all Free Nets financial contributions from the users are voluntary; some Community Nets, on the other hand, require payments for use. However, there is usually free access for those who are unable to pay. The first of these Community Nets began in Victoria, British Columbia, in 1992, followed by the Ottawa Freenet in February of the following year. Since that time similar nets have sprung up in urban and rural areas in all provinces.

Industry Canada, the Federal Government Department which has been given responsibility for fostering the "Information Highway", has worked with provincial departments of education in developing the **Schoolnet** programme which has as its aim the networking of all 16 000 public schools in Canada. Less than a year after the inauguration of Schoolnet, Industry Canada announced the **Community Access Programme** (CAP) which is intended to assist rural communities in obtaining Internet access. The Schoolnet programme is seen as a catalyst for the CAP programme and wherever possible schools are encouraged to facilitate Internet access and training for the community as a whole. In this way, the Federal programmes are also making a significant contribution to an increase in general community access to the Internet and the training opportunities it provides.

For those who do not have access to computers most Community Nets provide Public Access Terminals (PATs). These are located in public libraries, senior citizen homes, laundromats and a range of other locations where there are gatherings of people. However, in addition to access, an equally important component of the Community Net is the information it gathers and makes available. In some respects the Community Net is a new version of the community newspaper. Adult education and training is also rapidly becoming another facet of these networks. In some cases the training is organized by or through the local organization but more often it is identified by the local group and advertised by the local Net. A Community Net slogan recently coined states "we will train you to use it and you use it to train". A community of about five hundred in Nova Scotia, Tatamagouche, intends to establish what they refer to as the Tatamagouche U which will be a page on their Community Net with links to course offerings from a variety of university, college and adult education sources. To give some sense of the growth possibilities of Community Nets, Halifax, a city in Nova Scotia with a metro population of about 150 000 had approximately 10 000 users after one year of operation.

A small group of computer science professionals at Dalhousie University are responsible for the development of the software used by the Halifax Community Net known as the **Chebucto Suite**. Recently this software was selected as the best in Canada for Community Net use. With the assistance of Industry Canada the Dalhousie group is being encouraged to package the software so that it can by used by any community as the basis for a cost efficient network.

Related to the trend towards increased access to the Internet is the ever present problem of providing reasonably priced access to these new services to the more remote areas. Exploratory work is now underway in the use of radio transmission between Internet nodes and remote areas as an alternative to long distance calling. The cable companies have also begun to provide digital interactive services to their subscribers at higher transmission speeds than those offered by telephone companies. Cable access to Internet is being trialed in several Canadian provinces, although almost exclusively in urban areas. In the future households may be able to obtain Internet access along with their Cable TV connection. Some of the more adventurous Internet users are using the service for the transmission of voice and live video, services which are expected to improve in quality as software is developed specifically for these applications.

Introduction to the case studies

The three case studies which follow focus on adult second language instruction. Though the environments in which the programmes take place and the specific objectives of each are somewhat different, there are similarities in their overall objectives and intended outcomes. In all cases the students are newcomers to Canada; in the first two examples the students are recent arrivals who have enrolled in second language programmes in preparation for a future in a Canadian community. In the third example the participants have come to Canada for their post secondary education and most will return to their country of origin.

In each of the three examples the focus is on the application of a technology and its role in the overall programme. Case one documents the benefits of using an existing technology, closed captioned TV, which was initially intended for the use of the hearing impaired. Case two documents an approach used to develop a distance education version of an existing classroom based second language programme. In this case use is made of the telephone and the tape recorder with the option to use a computer assisted programme for additional support and enrichment. The third case combines a classroom approach with a very sophisticated individualized lab programme.

What is interesting about the case studies is that although they are dealing with this rather narrow area of adult second language training, they span a wide use of technologies. Comparisons of the approaches to the use of the technologies in the three examples are reviewed afterwards.

Case 1 -- Closed captioning

Closed captioning of films, videos and television which began about fourteen years ago was initially intended solely to meet the needs of people with hearing impairments. Its use in second language training is now being tried in both the United States and Canada. This case study examines the use of closed captioning technology in an adult second language training project carried out at Sheridan College during 1994 by Canada Captioning Inc. with funding provided by the Canadian government using decoding equipment supplied by the local television service provider.

"Closed captioning" or simply "captioning" is the term used to describe the process which enables a written version of what is being narrated or spoken in a television programme or on a video to be seen at the bottom of the TV screen. In order for the viewer to see the captions, a decoder must be used. Initially decoders were remote from the set and had to be attached; however, it is now common to have such devices built into the TV set. In some provinces the external decoders are made available by the local cable television service provider; in others they must be bought or rented from other sources.

Due to decreasing costs of captioning and an increase in the demand for its availability, its use has grown significantly. At this point, in excess of half of all television programmes broadcast in Canada are captioned. Another reason for this growth has to do with the introduction of legislation in the United States known as the Decoder Chip Circuitry Act which required that as of 1994 all TVs over 13" must be equipped with built-in closed captioning decoders. Because manufacturers do not differentiate between the Canadian and United States markets in producing televisions, approximately 85 per cent of TV sets now sold in this country have the built in decoders.

Although some research in the use of captioning in language training had been conducted in the United States and while language trainers surmised intuitively that captioning would be an asset to language learners, it was not until Canada Caption Inc. undertook the 1994 study that there was any formal attempt in Canada to evaluate the use of this technology for use in second language programmes.[2]

Purpose of the programme and the target group

The pilot project on which this case study is based took place from January 1994 to July 1994 and involved a total of seventy eight students who were newcomers to Canada from a number of countries. The students had all enrolled in the Labour Market Language Training (LMLT) programme funded by Human Resource Development Canada, the Federal Department responsible for the Labour Market Language training. All instruction given was in keeping with the regularly prescribed LMLT curriculum which is intended to prepare newcomers to the country in finding employment in the Canadian workplace.

Course content and the use of technology

The LMLT programme is classroom based and instructor led. For the purposes of this study there were two instructors who worked as a team. The teachers prepared a course guide based on the regular materials used in the LMLT programme. The programme uses a variety of approaches such as role playing, discussion sessions, use of videos and home assignments. The course outline includes resources and exercises which deal with: job search, reading, writing, pronunciation and grammar practice.

The six-month period designated for the study was divided into two twelve-week blocks. Session one was used as a trial for the final study to be carried during the last twelve weeks. At the conclusion of the first session minor modifications were made in content and approach in preparation for the formal evaluation during the second session.

For the purpose of this study the thirty-nine students during each of the two sessions were divided into two groups. One group, the study group, was given decoders which would be used during class and at home to enable them to access the print captions accompanying the selected programmes. The second group, the control, was required to view the same videos or television programmes without captioning.

The television/video aspect of the course had both formal in-class and informal or home viewing components. During the in-class time both groups of students were shown programmes which related to their course (employment or work situations). The challenge for the teachers was to find programmes designed to prepare students for finding employment while at the same time assist them in mastering necessary language skills, particularly language skills appropriate to the workplace. Added to this was the need to find programmes which were captioned. Two job search oriented video series with captioning were found. As well a number of short portions of commercially available videos were selected which complemented other areas of the LMLT course designed to teach commonly used language structures, grammar, idioms, verb forms, etc. However, in general the teachers found it difficult to find resources which had both suitable language content and subject matter appropriate for the course.

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[2] Beverley Ostafichuk, Canada Caption Inc. (1994), "The effect of captioning use on language acquisition of adult ESL students", Mississauga, Ontario, mimeo.

In order to prepare for the use of the informal television viewing at home, teachers had to become familiar with the schedule at the local television channel in order to determine which programmes were captioned. The programming selected covered a range of genre including comedy, drama, news and documentary and the instructors attempted to limit the selection to those programmes which they felt had appropriate language levels. Each student was asked to sign an agreement to view at least three hours of assigned television each week. Students indicated they all had access to TV and the majority had access to cable. It was also found that none had any previous experience in using captioning. All students indicated a willingness to participate and cooperate in the study. During the first week of the programme the students in the study group were introduced to the decoding equipment and use of it began. In all cases the study group used the captioned version while the control group viewed the non-captioned format.

The at-home television viewing for both groups began during week two. A specific programme was assigned and students were asked to make notes based on "who, what, when, where, why and how". They were also assigned the task of viewing a commercial and a newscast of their choice. In all cases there was class discussion as a follow-up to the viewing assignments. Apart from the specifically assigned programmes students were asked to keep a weekly journal of all home television viewing. These journals were reviewed by the teachers on a regular basis. The formal and informal viewing exercises continued during weeks two to eleven. In the classroom setting teachers selected videos which corresponded to the topics being covered. Segments were usually not more than fifteen minutes in length and each was followed by discussion and appropriate assessments such as worksheets, dictation, composition assignments and quizzes. In the case of the home viewing assignments the follow-up was a test given in the class on the next day. To prepare the tests the teachers were required to watch the selected programme as well. Programmes from a different genre were chosen each week to ensure a variety of language experiences.

Following the first twelve-week session there was a thorough review of the test results. Based on this review it was determined that changes had to be made in the selection of videos both in terms of the language level and the number to be shown. Other than these changes the content and approach for session two was a repeat of that used in session one at the end of which the formal evaluation was carried out.

Conclusion

The results of the pilot were encouraging in that the increase in test scores of the study group was significantly higher than those of the control. The authors report the results as follows:

In comparing the overall test results one sees that over the twelve-week teaching session the comparative improvement in average test scores (over the pre-test average) for the study group was almost double that of the improvement achieved by the control group. As was expected each group's average improved considerably, which testifies to the success of the LMLT programme itself; however, the most important finding for this study is that the use of closed-captioning by the study group produced significantly greater improvement in overall language acquisition.

Teachers were impressed with the general interest of all the students in using closed-captioning both in class and at home. They observed that students were more enthusiastic about the material and more eager to watch when using captioning. A very significant observation by both teachers was that the students in the study group learned new material more quickly.

In general teachers were convinced that use of closed-captioning assisted students in acquiring new vocabulary and structures while improving the confidence of the students in their new language skills.

Case 2 -- A distance education ESL programme[3]

Language Instruction for Newcomers to Canada (LINC) is an English as a second language programme for adults sponsored by the Federal Government and delivered by educational institutions in communities throughout Canada. The LINC programme dealt with in this case study is being offered at the regional level in Ontario. The Halton Region located near Toronto is composed of five communities ranging in size from Oakville with a population of about 20 000 to Acton which is about one third that size.

The Halton Board was concerned that some newcomers to Canada living within their region were not able to take advantage of their classroom based LINC programme. LINC-On Your Own is a distance education version of the programme intended to meet this identified need. A trial of the Halton programme began in September of 1995 and is due to conclude in May of 1996 when an assessment will be made.

Purpose of the programme and the target group

The objective of the LINC programme is to assist newcomers to Canada in achieving a level of literacy sufficient to enable them to participate in the workplace and the community environment. The approach to the delivery of the LINC programme in the Halton Region was to offer classes but this did not meet the needs of all newcomers seeking language training. This was either because there were not classes available in their communities or because they were unable to attend classes due to transportation difficulties or household commitments. In response to this concern, the Board contracted consultants to: a) examine the ESL needs in Halton which could not be met through the traditional class approach and b) conduct a survey and an assessment of possible distance education solutions.

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[3] Two reports were used in the preparation of this case study: Mindfarers, Inc. (1993), "Identification and review of existing learning systems, materials and techniques. LINC-On Your Own Stage 2", Working document, Halton LINC Distance Education Committee and Employment and Immigration Canada, Ontario; Mindfarers, Inc. (1993), "Design of the distance education model. LINC-On Your Own Stage 2", Halton LINC Distance Education Committee and Employment and Immigration Canada, Ontario.

Course content and the use of technology

The research carried out by the consultants focused on three basic models: print based, video based and resource centre-based. From an initial investigation of some thirty programmes, fifteen which fitted within the three models were examined. The programme review considered such attributes as flexibility (which included the opportunities for multiple entry points and continuous intake of students); the level of student support; the opportunity for interaction; the ease of implementation and management; the ability of the programme to reach dispersed learners. While Halton did not wish merely to duplicate the classroom delivery, the distance programme had to achieve a similar outcome.

The distance education programme which was developed for Halton was based on an expanded version of the ESL distance learning programme which had been developed by the Open Learning Agency (OLA) in British Columbia. These materials had been initially developed in 1984 for a similar target audience and at the time of the Halton survey they were being used in distance education ESL programmes in three provinces. A major advantage of the OLA materials, which were designed to take students through four levels of language skills, was that the levels could be adapted to the three levels which were the basis of the LINC programme. The OLA course delivery resources consisted of print materials and audio cassettes. Video materials were planned for the future. Built into the programme was the use of teachers or tutors who would provide support for students via telephone communication.

The community needs survey conducted by the Halton Consultants found that virtually all potential students had access to a telephone and approximately 97 per cent had access to a tape recorder. Contrasted with this was the availability of the computer which was discovered to be about 17 per cent.

The OLA course content was developed in units or modules each containing the appropriate print and tape materials. This approach enables students to individualise their learning by selecting units or topics which interest them and it also allows them to work at their own pace. The modules are divided into small units which include reinforcement and practice exercises which students can redo as often as they like until they master them. The content of the OLA materials was found to be similar to the LINC programme in that it is based on themes such as meeting people, exchanging personal information, taking telephone messages, dealing with directions, etc. The curriculum focuses on language functions and language used in context. The language instruction -- structure, pronunciation, vocabulary, grammar -- is all integrated into the themes and situations presented by the course material.

The basis of language teaching is usually conversations or interchange among students and between the student and the teacher. While this can easily be accommodated in the classroom, in the case of the distance version, the Halton programme developers use a combination of print, taped instruction and taped dialogue to simulate the classroom experience. The practice is to have the student follow illustrations in the text and then listen to the tape. The teachers report the taped material to be excellent and they suggest it emulates natural conversation. Following the use of these exercises, students are well prepared for the kinds of conversation they will hear and have to respond to in community and work situations.

In order to provide for live interaction and additional instructional support, there are the opportunities for conversation through telephone communication with a teacher/tutor and with fellow students. In the case of the OLA approach the calls were made once each month. The Halton programme increased these to one each week and calls among peers were arranged for as well. Apart from the value of the conversation as a means of building language skills, the developers also consider the opportunity for teacher feedback and positive reinforcement to be very important. As well there is the hope that the interaction among students will lead to students having a sense of being a part of a "community of learners" able to support each other.

A home based distance education approach does not usually allow for a rich learning environment because the many resources found with most classrooms and their associated resources centres are not available. In order to provide a limited compensation for this deficiency the consultants decided to include the opportunity for computer aided support. Computers or workstations for this purpose with the appropriate software would be made available at existing cultural centres and in public libraries. Considerable time was spent in identifying and customising appropriate software programmes which a) related to the LINC approach; b) would complement the existing units; and c) could be used by students with little or no computer background.

The role of the teachers and their support to the students is key to the Halton programme and all teachers are required to have adult education qualifications. During the period of the trial the work of the teachers is coordinated by a person contracted by the Board. For the purposes of this project the Board identified a pool of candidates from whom the Coordinator could select the teachers as the students enrol. In general all prospective teachers are involved as part-time or supply teachers in second language programmes. Because the Board wishes to have feed-back from as many people as possible during the trial, the ratio of students to teachers is kept very low. In fact most teachers have only one student.

Once the level has been established and the student approved for the distance programme the next call is from a teacher who will orient the student and make arrangements for the ongoing telephone interaction and assignment exchange. The print materials and audiotapes which compose the programme are divided into six modules within each of LINC levels two and three. At any one time the teacher and student each have the materials for two modules. To facilitate a common understanding of which part of a module is being referred to, the materials are carefully colour coded and use is made of descriptive visual icons.

In terms of the time commitment, the home programme is meant to parallel the in-class version which may require up to 250 hours to complete each level. There is no attempt to monitor the time spent by students at home and teachers rely solely on assessment results as a means of determining whether a unit has been completed and as a means of setting the pace. Unlike the classroom where a variety of resources is available, a problem faced by the distance programme is that if a student has completed all of the exercises in a unit but has not been successful in achieving the objectives, there is no recourse except to repeat the use of the same materials. In the case of the in-class student there is the option for personal attention and remedial work.

At least once each week the student will phone the teacher for assistance or to do an assignment. The exercises which are assigned for use in the telephone exchanges are in the print modules and make use of pre-scripted conversations which are then carried out between the teacher and student. The teacher may record parts of the telephone conversation and send it back to the student with comments by mail. While this was a routine practice in the OLA programme, in the case of the Halton project this is done less often. This appears to be because of the more frequent calls between students and teachers in the Halton Region. In Halton the plan is to have each student participate in a telephone call of one hour duration each week but this is sometimes extended because of the students needs.

The computer component of the Halton programme is an addition to the approach which had been adopted from the OLA. It is considered an option and is intended as an additional reinforcement. The notion is that students can make use of the computers at the end of a unit of study with a view to consolidating and extending what had been previously learned. However, this experience also provides another useful language opportunity. Two of the software packages are customised versions of language programmes dealing with grammar and language structure. Great care has been taken in preparing the instructions and the programmes have been made "student proof". A more advanced component makes use of a word processing programme. This utility software has been pre-programmed so that the student is led through a series of writing exercises. Initially, the exercises are supported by detailed on-screen instructions. As time goes on the student is expected to progress to being able to follow normal computer prompts. Some of the writing exercises involve practical applications such as the preparation of an invitation to an event. The developers of the Halton programme believe that the use of the computer component will require that the student have assistance, at least in the initial stages, and this is to be provided by community volunteers.

Conclusion

While it is premature to [illegible] Halton project, OLA reports they are having succe[illegible] cent as compared to 25 per cent for the regular adult [illegible].

It is clearly the application of the tape recorder which is at the heart of the Halton programme and the pervasiveness of this equipment means that similar programmes can easily be implemented elsewhere. Teachers also find the phone communication very effective for teaching, once they have gained some experience. They suggest the phone has several instructional advantages which result from the student's ability to focus on the task and to control the situation. Since the call is initiated by the students these conversations occur at their preferred time and it is assumed students call only when they are ready. Teacher observe, too, that during the call students are not distracted or intimidated by other learners.

In view of the survey results of the availability of computers for students it is essential the computer component does not require students to have computers at home and in fact the software licensing arrangements in use in the Halton Region at present require that its use for this programme be limited to the public access workst[illegible] be noted in the next case study the use of computers in lang[illegible]e.

Case 3 -- Language lab support

For more than twenty years, Seneca College has been working with HOMECOM Learning Systems Ltd. (both of Toronto, Ontario) in developing computer based learning programmes. HOMECOM's CAN-8 instructional system was first used at Seneca for math courses. The technology consists of networked computers connected to a file server. The file server acts as a central storage base for course software, and records students progress. The teacher's computer screen displays individual student's progress in completing the course or exercise. Students who are having difficulty with particular concepts can be easily identified and assisted by the teacher. Students who wish to progress at a faster pace have the option of doing so.

Seneca's early experiences using the CAN-8 system indicated that courses could be completed more quickly and student drop-out and failure rates were lessened. So much so that when Seneca College established the English Language Institute four years ago, computer assisted learning was integrated into the new courses.

Purpose and target group

Seneca's second language training programme is designed for young adult students in Canada on visas who are intending to go on to post secondary education at the College. Because these students have already achieved a relatively high level of education in their home country, and expect to complete further levels, they are a rather different target group than those in other two case studies. Seneca, in choosing to provide these courses, is fulfilling the second language needs of the students within their own institution. They are also increasing access to their institutions post secondary studies for foreign students.

Seneca had already experienced the effectiveness of computer based training in other courses so that when they began developing course material for second language training they immediately realised the potential benefits. In cooperation with HOMECOM, they began developing software and course material tailored to their target student population. Unlike the earlier technology, the newer system incorporated the ability to communicate by voice. The importance of this advance for language training is clear. Students can now speak and be spoken to by the computer thereby aiding in pronunciation and sentence structure skills.

Course content and approaches to technology

Seneca College currently has 200 students enrolled in English as a second language. These students are divided into eleven classes on the basis of their level of proficiency. Students are tested at the beginning of the seven-week course and assigned to the appropriate class. There are eight levels in total. Typically students are able to complete 4 to 5 levels, or modules per year.

Each level is seven weeks in duration with each week consisting of 25 hours of study, 20 of which are in class with the remaining five spent in the language lab. The work performed in the CAN-8 lab comprises 10 per cent of the students final mark (an added incentive for using the lab). In addition to the five hours of independent work by the students, the teacher accompanies the class in the lab for two hours. Additional computer use to further hone skills or work on problem areas are accommodated through scheduling of the lab. Students are advised of the times which their class has access to the facilities. A technician is always present in the lab to assist students in the use of the technology and to carry out the instructions of the teacher. It is this component of the programme where cost savings are readily apparent. The technicians, although well paid, are paid less than teachers. Substituting computer time with in-class time can thus result in immediate and identifiable cost savings.

Cost is certainly not the main reason for using the CAN-8 system at Seneca. The benefits of students being able to study at their own pace, repeat assignments with which they had difficulties, together with the computer-aided evaluation of student progress are very significant. Students can listen, speak and compare themselves with the recorded model without pausing. Digitisation of all audio information allows students immediate and random access to a precise spot in a word, sentence or dialogue. CAN-8 can be used for drill and self-paced study. Teachers can monitor student progress and assign drills according to individual need. Graphics are easily incorporated to stimulate interest and increase time-on-task.

CAN-8 is a multimedia interactive system which can accommodate up to 200 workstations. The system is normally used in a local area network, or lab environment but can be used for distance education if adequate communications capacity exists. The system requires ISDN lines to achieve full functionality, particularly continuous ongoing communication by voice and data at the same time. In Canada, where it exists, ISDN service can be expensive.

The CAN-8 system is rarely, if ever, used in its' "canned" version, rather the software and course content is modified to suit the individual learning objectives of the institution. Seneca has developed an expertise in working with the CAN-8 system and has become proficient at authoring courseware. Cost and appropriateness of packaged software for the College's programmes were the primary drivers in developing this expertise. With their relationship with HOMECOM, Seneca has been able to integrate the courseware needs with the technology. Seneca still uses other software packages and content produced elsewhere. (For example, they use videotaped lectures from Saint Mary's University in Nova Scotia, delivered over the CAN-8 system to the student's computers in the lab to develop comprehension and listening skills.) Although the CAN-8 system supports the use of any IBM based software, some of the functionality of the system is lost. This is particularly true in the systems ability to monitor student progress.

Conclusion

Seneca College, in cooperation with HOMECOM, has integrated technology into their second language programme to the extent that the software and courseware match the requirements of their students. The technology is still only one component of the programme but offers students additional control over the style and speed of instruction.

In evaluations of the effectiveness of the programme, Seneca has found their students obtained a 50 per cent higher grade point average in further studies than did students who did not complete their programme. While the use of technology can not account for all of this success, Seneca feels that it is an integral and highly effective component of the programme.

Seneca College is the prototype location for this programme in Canada. However, there are a number of other Canadian and international locations where the system is in use. Essentially HOMECOM has developed a component which allows the conversion of a Novell networked computer lab to a second language training facility. The system allows students to input and output print and voice as well as video.

Similar systems are in use in Saskatchewan, in several Military Installations in Canada and in Mexico and Italy.

Comparison of case studies

What is encouraging about the results of the closed captioning trial is that its use can be incorporated easily into other second language programmes and in fact it would appear to be a useful tool for any literacy related programmes. Such uses will obviously become more possible as the older TV sets are replaced with the newer versions with the built in decoding equipment. It is interesting to speculate about the role captioning might play in the teaching of language in the elementary school.

Apart from the use of this technology in formal programmes, it would be possible to design closed captioning viewing guides to assist people at home wishing to use the closed captioning approach to improve their language skills. The learning possibilities this technology makes available may also lead to a renewed interest in adding captioning to existing programmes as well as future productions.

The distance approach developed for the Halton District is very attractive, on the one hand, in its use of such available technologies as the tape recorder and telephone and, on the other hand, very inventive in providing access to a rather sophisticated computer assisted component. The fact that the tape recording equipment used in the Halton programme is so readily available has little to do with educational needs but rather is a result of the successful marketing of home entertainment products. This raises the question as to whether future trends in the home entertainment market will lead to homes having ready access to audio recording or will newer equipment be for playback only? Secondly, will it be as cheap and as easy for educators to produce and duplicate audio programmes for home use as it is now?

The telephone system provides the very important link between the student at home in the Halton Region and the teacher. The ideal situation would be if both the student and the teacher had connections which also allowed for written or still image exchanges or live visual interaction (perhaps provided through the local Community Network). A further use of the telephone service would make it possible to link computer labs in community schools to programmes such as the one offered by Seneca. In this way advances being made in one region of the country could be shared with others.

The Seneca case study provides an example of the effective use of state-of-the-art technology adapted to specific learner requirements. One of the most interesting aspects of this programme is the level of effort Seneca has invested in making the technology work for them. Through courseware development, successful integration of technology, and commitment to having the students use the technology, they have successfully enhanced the effectiveness of their programme.

The section which follows identifies a number of similar issues which relate to the use of technology in support of adult education.

Implications for practice, research and policy

The purpose in reviewing the trends in Canada in the use of technology in education is to draw conclusions which may have some relevancy to all OECD Member countries. This section highlights the major issues and makes general observations for further development.

Availability

The availability of technology for the learning environment involves both infrastructure and technology (hardware and software) issues. Although Canada has extensive communications infrastructure, provided predominantly by broadcasters, cable television and telephone companies, improvements are an ongoing requirement. Cost has been the major impediment to increased use of the infrastructure already available. This issue is well understood and attempts are being made to address it now through special rates for educational institutions to be provided by telecommunications carriers. However, when faced with burdensome costs, educators have become innovative in their use of available infrastructure. Two of the case studies detailed in this report demonstrate effective uses of services which are generally available at no extra cost to learners: the use of closed captioning to supplement other learning media, and the use of telephone contact with students who have difficulty leaving the home for formal classroom study as outlined in the LINC project.

Compatibility of software and infrastructure pose difficulties. For example, there are three different audio-graphics software systems in use. It has only been recently that the developers of these products have attempted to establish standards and interoperability among systems. Care must be taken when choosing technology to ensure, as much as possible, that systems can function with other systems if and when required.

Being able to acquire technology with limited budgets is an ongoing problem. Canada has developed an innovative programme which could easily be adapted for other OECD countries. "Computers for Schools", a technology recycling programme sponsored by the Federal Government, has now spread across the country. The programme takes advantage of regular upgrades of computers and computer systems by businesses. The old computers, which are of little or no resale value to the company but are more than sufficient for classroom use, are donated for use in schools. Before being distributed to the schools, the computers are refurbished at depots, usually by volunteers.

The availability of infrastructure and technology, at affordable rates, for educational use will be an ongoing issue for Canada. However, this issue is becoming better understood and has resulted in some of the innovative solutions outlined throughout this report.

Accessibility

Technology can clearly increase access for learners, particularly adult learners who may be unable to leave the home to attend classes or may have job requirements which are not conducive to study during normal hours. Again, the closed captioning and LINC programmes demonstrate this. A feature of both these programmes is the use of technology (television in the case of the closed captioning example and tape recorders for LINC) which is readily available, and already owned by the students. A conscious effort was made in both cases to ensure that the cost of participating was not a deterrent to learners. Inherent in this feature is that the equipment is familiar and easy to use for both the educator and the learner.

Adult second language learning often involves students from cultures who have had little or limited exposure to what Canadians consider basic technology. There have been situations with the LINC programme, for example, where the student must first be taught how to use the telephone. Being sensitive to the technological competency of the target learners is particularly important for distance education because the educator is less likely to find out quickly that the learner is having difficulty. Frustrated learners often drop out of programmes before completion. By choosing a commonly used technology, the availability of the course is enhanced and the learner can focus on the course material rather than the means to receive it.

When more advanced technology is used, it is imperative for effective learning that both educators and students are trained in its use. Teleconferencing is different from watching video programming, audio-graphics use is different than the use of a computer alone. To get the most out of the technology and the learning situation, the functionality of the equipment and the needs of the learner for interaction must be understood. In some situations, such as the Seneca programme, the resources to assist in the effective use of relatively sophisticated technology are always easily accessible to the learner.

Cultural bias

Education is fundamental to the preservation and promotion of culture. For adult second language learners cultural issues can be more pronounced than with other students. These students, often recent immigrants, bring cultural practices which can affect the learning process. For example, because of historical problems in their native countries, sometimes students are reluctant (or refuse) to interact with students from other cultures or of a different gender. These concerns cannot be ignored and should be recognised in designing course material and planning for student interaction during the programme.

An additional cultural issue is that of course material, particularly software, developed in a country or culture different from the educational setting. We Canadians, although sharing many common traits and interests with our neighbours to the south, have always been concerned with preserving our culture. Yet much of the prepared software available to support technology-based learning is produced in the United States. Cultural bias in the educational environment is viewed more seriously than in other spheres (such as leisure activities which might involve foreign television programming, films or books). For this reason, content for courses should be carefully selected and whenever possible, content that can be modified to suit the learners culture should be adopted. Using available content such as television programming for second language training raises concerns about dialect, variations in pronunciation, the use of slang or colloquialisms, and even the use of profanity. On the other hand, the instructor/teacher may choose to use programmes which feature these concerns for the purpose of illustration or discussion. The closed captioning programme illustrates this point; as the instructor chooses the programmes which the student is asked to watch.

Gender equality

The use of technology for adult second language learning offers an important opportunity to promote equality, particularly for women. For many immigrant families, often the wife must stay at home while the husband works, which can result in isolation, trouble in integrating into society, and deficiencies in learning language and skills necessary for interaction in the community. It is only recently that this issue has gained widespread attention in Canada. Offering programmes in the home, as with the closed captioning and LINC programmes, may prove to be an effective means of addressing this problem.

Copyright of materials

The Canadian government is in the process of revising the Copyright Act, much of which was enacted in the 1930s. The first phase of these revisions is complete but the sections dealing with education uses has been left for phase two. The existing act provides for extremely limited exclusions for education and it is anticipated the revised act will not substantially alter this approach. This is partly due to the size of the education market in Canada which is proportionately larger in terms of the total market than is the case in United States or in a number of other countries.

The Copyright Act provides for "collectives" which are able to act on behalf of copyright owners. For some time there have been collectives for the holders of music copyright through which educators are able to access an education-use rate which is lower than that charged commercial users. A more recent development is CANCOPY, a collective for authors, publishers and other print copyright holders, which is in the process of negotiating agreements with provincial departments of education, universities and libraries for the right to copy materials owned by their members.

Cable in the classroom which is referenced earlier in this report, though not a collective, represents an attempt on the part of the cable operators to provide educators in Canada access to post broadcast use of television programmes similar to the access already available in the United States and in several other countries. While the arrangement in the United States allows for the copying of nearly all programmes with some exceptions such of pay-for-view, the Canadian plan is more selective; however, this limitation is somewhat compensated for in that the uses which are allowed in Canada are less restrictive.

It is unlikely there will be a collective similar to CANCOPY or an arrangement such as Cable in the Classroom for computer software. However, concessions are made for educational uses through site licenses and bulk purchase arrangements. Halton's programme outlined in the second case study takes advantage of such an arrangement.

In the case of the print materials the contracts are quite specific about who is able to do the copying and under what circumstances. While access to copying privileges for adult courses may be allowed in those cases where they are under the public education system, negotiators will have to be careful to arrange for as broad an access as possible if all adult programmes are to be included. If all private adult training programmes are excluded, this may cause a problem. Since it has only recently been announced, it is not yet clear whether adult educators will have access to those resources made available under the Cable in the Classroom arrangement.

Countries with small populations such as Canada will always have a problem in balancing the rights and needs of the creators of works with the access demands of the educational community.

Private education

As governments and businesses "downsize", the requirements for training and retraining increase. At the same time, the public sector's ability to respond to this increased demand has been decreasing. These unmet demands are resulting in new opportunities for the private sector to become involved in providing training. Continuing and adult education are increasingly being recognised as new "markets". It is interesting to note that the Seneca second language students pay for the full cost of the programme; there is no government or college subsidisation. Private sector institutions usually have more flexibility to respond to new training requirements and are usually able to react more quickly to the "learning marketplace". However, public policy issues related to defining and monitoring standards of private training need further development. In Canada, education is a provincial rather than national responsibility, which makes national standards, even for public education, difficult to establish. Most of the private interests involved in education would welcome policy guideline and regulatory standards to facilitate the acceptance of their programmes by traditional educational institutions and employers. While this issue tends to be considered a national one, with the progress of communications technology, and as educational resources become available on an international basis, it will become an international concern.

Private sector involvement in public sector education

Government budgetary cutbacks have resulted in an increase in private sector involvement in public facilities. At one end of the spectrum is the contribution of goods or services by the private sector as a charitable gesture. The other end of the spectrum may involve full privatisation, or more often, public/private partnering to provide everything from learning materials and equipment to the school buildings. This can be a very contentious issue and is usually dealt with on a case by case basis by the public authorities responsible for education.[4] Overt commercial content in educational material tends to be rejected outright. Passive advertisement (such as the use of brand name equipment) is more acceptable. This issue, and the depth of feelings about it, tends to vary depending upon the age of the learners involved. For adult learners, who are accustomed to a commercial world and have a greater ability to assess commercial content, the involvement of the private sector in providing materials or equipment may be more welcome than would be the case with younger students.

The issues and trends reviewed in this report suggest that the use of technology in support of adult education in Canada will continue to increase.

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[4] One recent contentious proposal presented to educators across Canada was an offer to provide schools with equipment for receiving video programming. The programming would be created specifically for school use and would contain commercial advertisements. In return, the schools were asked to guarantee that the students would watch the programming (and advertisements) and respond to periodic marketing surveys. Educators were quick to rally against this project.

DENMARK -- THE COUNTRY OF THE CLASSROOM

by
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The national context

Denmark -- A country deeply rooted in the classroom as a mode of delivery

If an alien had parachuted into Denmark in 1995 without knowing anything about the country -- but by some miracle being able to read Danish newspapers -- then he or she would have got the impression that the whole educational system was on the point of collapse due to a lack of information technology. All things are relative, however, and public debate tended to focus exclusively on computers (or rather the lack of them) in primary and secondary schools.

Technologies and educational aids have been part and parcel of the Danish educational system for hundreds of years. Books, blackboards and chalk have been joined by overhead projectors, audio cassettes and video. Many of these aids are well suited to a country which is densely populated (population 5.2 million, area 44 000 square km). Denmark has a long-standing tradition of free public education. Unlike most other countries, educational institutions are spread relatively uniformly all over the country. With the exception of a few courses at tertiary level, admission is free if the student meets the entry requirements in full.

This high population density, and the correspondingly short distances from the home to educational institutions coupled with good public transport and roads account for the more than a century-long tradition of adult education at evening and weekend classes. All these elements are conducive to the classical education pattern of schools and colleges of bricks and mortar, to which students and pupils of all ages can go to the classes on a daily (or -- for adults -- weekly) basis where they meet their fellow students and teachers for lessons of 45 minutes. This delivery mode, supported by levels of educational funding which are high by international standards, has made it possible to sustain mean teacher-to-student ratios of 1 to 20 in most parts of the system.

Until recently, it was thus understandable that for most Danes including professionals in the educational sector this was *the way* to teach and learn. Of course there was an awareness of the existence of distance education. Teaching at a distance in the form of educational broadcasting (radio and television) and correspondence courses have all been available in Denmark -- and still are. But in a national perspective they have all been of marginal significance and no official educational policy on distance education as an integral part of the public educational system had been articulated until recently.

Even though public interest in developing distance education was almost non-existent, the government at an early stage considered the increased use of courses or course modules delivered by computer technology then emerging. The seventies were a decade of medium and long-term planning for almost every part of central and local government in Denmark. This was also the case for the educational sector, and in higher education in particular. As part of this planning exercise, a committee was set up to analyse the potential of computer-assisted learning (CAL) as an integrated part of course delivery in higher education. Even though some quite successful trials had been conducted in medical education, the overall conclusion of the committee was that this mode of delivery was still too expensive compared with other delivery systems, and that only skill-based learning tasks could be taught by CAL. At that stage, the assessment was that CAL was not generally applicable to higher education.

For this reason, until the nineties both distance education and technology-supported delivery systems as part of classroom education were regarded as delivery systems of little relevance to the mainstream of Danish education. I think it is fair to say that both were also deemed to be inferior solutions compared with traditional face-to-face tuition.

Computer literacy

While there was a lack of interest in distance education and technology-supported delivery, the use of computers in educational institutions was definitely on the agenda in the eighties. Computers were used in most schools (normally in the form of computer science rooms equipped with personal computers) with word processors for writing reports, spreadsheets and simulation software for science subjects. Pupils and students were also frequently offered computer courses in the use of computers and in simple programming. It was, however, up to the individual teacher and the local education authorities to decide whether and how computers were to be used in traditional face-to-face education. A discussion of the use of computers as an integral part of the educational delivery system simply did not exist.

In 1994 a widespread debate developed on the need for computer literacy as an important part of the general qualifications of all school children in order to prepare them for their everyday life on leaving school. The concept of the A and B team (the risk of the polarisation of society into the haves and the have nots on the basis of their computer literacy) was central to the general debate and also found its way into a government report on the Information Society towards the Year 2000. In 1995 one could say that the official policy and goal in almost every educational sector was ready access by students to computers and to communication networks. The technical infrastructure is, of course, a prerequisite for implementing new educational delivery systems on a large scale, but computers and networks do not by themselves change the nature of the mode of delivery. They can also be used in the context of traditional face-to-face education.

Providing the framework for new delivery systems -- The concept of lifelong learning

In the late eighties the framework for a comprehensive reform of the education of adults was being established. The background for this reform was the growing realisation of the need to create a system for lifelong education and training. To transfer the focus from an initial education and training system to one combining initial education and training and lifelong learning was a major task. This was also the point in time when distance education as an integral part of educational policy came back to life. By offering lifelong educational provisions in specialised fields, too, participation in education and training would have to make allowances for the adult's family and professional commitments. Courses would have to be closer to the students and would also have to be as flexible as possible to cater for student commitments at work and at home.

Looking for suitable models

The best-known model for a flexible degree programme for adults was the United Kingdom Open University (OU). It was characterised by being a special purpose distance education institution offering its own degrees. From an economic point of view, the OU was based on the economies of scale: mass education, second-chance provisions for full degrees, high initial investment costs, a long running-in period for course development and a long lifetime for the course modules developed because of the substantial costs involved. This model, which was launched some years ago in the Netherlands (another small European country with many of the same characteristics as Denmark) was also analysed as a possible role model for lifelong education in Denmark.

The conclusion was clear. This special purpose model was not found appropriate in a Danish context. There was no need for a second-chance system of that size. More importantly, there were clear indications that at the end of the eighties, computers and networks would be part of everyday life in most walks of society within a few years. In addition, although there was a need for more flexible course provisions for adults, there would still be a sizeable number of traditional brick-and-mortar institutions available within convenient travelling distance. It was therefore likely even in the future that a majority of courses would continue to be offered in forms to which the Danes have become so accustomed -- traditional evening and weekend classes, or courses on a full-time basis. To convey an impression of the popular support for such courses, statistics for 1993 show that there were nearly 1.7 million course enrolments in adult education courses out of a total adult population (those 18 years old or more) of just over 4 million. It should be noted that course enrolments are higher than the number of adults taking part, as a proportion of adults signed up for two or more courses. Even so, the figures tell their own tale of the popularity of this traditional provision.

Towards mixed-mode institutions

A political decision had been taken. There would be no need to create new institutions with the sole purpose of providing distance education courses for the adult population. Distance education was defined as a mode of delivery that any institution could use if it wanted to. Another key policy decision was that the new adult education system should be seen primarily as a system parallel to full-time educational provisions for young people. Courses could be taken on a part-time basis, in the form of distance education, traditional instruction or a combination of the two. The number of lessons in the new system could be different, but the examinations and the curricular goals were to be the same as in the traditional system. Credits gained in this Open Education system (as it was called in the law of 1989) were to be the same as in the traditional, full-time education system. If a student with credits from courses under the Open Education Act later decided to follow a full degree course in the traditional system of initial education, the Open Education credits would automatically be recognised.

Funding -- Carrots and sticks

Because courses would be offered by dual-mode institutions, the usual discussion as to whether the quality of distance education was first or second class was irrelevant in a Danish context. It would be up to the institutions to see that academic standards were high enough for their students to pass the examinations. Having students pass the exams is fundamental to the Danish system of funding education and training. This principle of results-oriented funding has gradually been introduced over the last decade and appears to be quite simple -- on the surface. It is simply based on government capitation grants for active students. The system is now used to fund vocational training, higher education, open education and to some degree to fund a variety of non-credit courses for adults at institutions financed primarily by central government. (Primary and secondary education is funded by local authorities and is based on different principles.)

An active student is defined as someone following and completing a given degree course at a pace and time in compliance with the norms for that course. If, for instance, a student takes two years to complete a one-year course, the institution is only paid for one year. The grant is paid when the student has passed the examination. Institutional outlays on students who drop out and students' use of extra study time are costs that are not refunded by government. By both defining distance education as a mode of delivery and applying these funding principles to distance education, institutions have an incentive to look for cost-effective solutions and also to minimise the drop-out rate in courses delivered at a distance. The basis for funding Open Education is somewhat different. There is a modest student course fee, which must be paid at least once every six months. Government funding in such cases is based on the number of students who have paid their six-month fee. While the systems and the definition of activity differ somewhat, the incentive to keep students active is still very important because institutions are obliged to complete a given course even where the drop-out rate has been so high that the course budget is in the red.

A national study

By defining distance education (and technology-supported learning) simply as a mode of delivery, the formal framework was in place for introducing technology-supported learning as a new delivery policy in the education system.

But the question remained whether the time had come to enter that path. The government commission in the seventies had reached the conclusion that the time was not yet ripe. More than a decade later, the Ministry of Education commissioned a new analysis. A committee of experts was appointed and started its work at the beginning of 1992. The mandate was quite clear. The committee was to analyse the possibilities of using technology-supported delivery systems on a wide scale for the education of adults. It was to set up a number of scenarios and analyse whether the changes described would be cost-effective within a ten-year time frame. In contrast to the discussion of the use of computers in schools where the issue focused on the introduction of computer literacy as a part of every pupil's general qualifications, the focus in the expert committee was clearly on the delivery system. The government intimated in no uncertain terms in their terms of reference that unless the committee could convincingly demonstrate that over a ten-year period the cumulative operating costs as the result of any policy change for delivery systems would be budget neutral, the government would retain its existing framework policy: setting the rules for distance education and technology-supported learning but not actively initiating change.

The findings of the committee

The government committee finished its work in June 1993. It made three main points:

- The first concerned operating costs. When comparing the cost trends of technology-supported learning for the present decade with those of traditional face-to-face education and training, the latter is not economically stable. With staff costs accounting for approximately 80 per cent of expenditure, it would be difficult for the traditional system to achieve genuine productivity gains comparable to those in the private sector. If increases in teacher salaries were to match the average increases in society as a whole, and given that the quality of educational provisions is to be maintained the likely consequence was that the total costs of traditional education would gradually increase.

  The committee thus pointed out that comparisons between traditional face-to-face education and new modes of delivery have to include issues such as these which are inherent to the cost structure of the traditional provisions.

- The second issue is the potential of elements of alternative modes of delivery to achieve long-term productivity gains that would be impossible in the traditional system. Among these are constantly falling unit costs per student and the potential of some systems to cope with huge class sizes, allowing high investment costs to be written off within a reasonable time. However the committee also pointed out that some of these advantages are very difficult to reach in a small country with its own language, because the absolute number of students is limited.

- The third issue is more political. For its scenarios, the committee took as its point of departure the fact that technology is undergoing rapid change while the needs of various learner groups changed more slowly. It was therefore very important to chose a mode of delivery for each group of learners specifically tailored to their needs in an educational and social context. (This does not imply that the committee endorsed the development of tailor-made learner platforms or hardware designed for education. On the contrary: the committee felt that "off-the-shelf" solutions for both hardware and software should be chosen wherever possible to hold down development costs.) It also pointed out that, due to their flexibility, many of the new delivery systems were well-suited to lifelong learning and to the Danish family life style in which both parents normally have full-time jobs.

  As regards the cost efficiency of educational provisions in a small country the point was made that not only could the new delivery systems be adapted to the education of adults but they could also be a part of the "traditional" delivery system for full time education and training. Furthermore, the legal framework of Open Education, offering the same credit courses as in the full-time system, would facilitate the reuse of courses developed for the education of adults. A further advantage was that some of these systems based on "distributed learning", as one of the scenarios was called, would improve the economics of provisions to small, dispersed institutions and thus offer the local population a wider variety of courses than would otherwise be the case.

The scenarios in the report

The report described three scenarios, but stressed that they should only be looked upon as standard models which could be adapted and combined in accordance with learner requirements. The committee also pointed out that the scenarios and their constituent parts could be combined in many ways so to fit a given target group.

The three scenarios were as follows:

- The time-independent learning model.
- The simultaneously-distributed learning model (distributed learning).
- The independent study model (differentiated learning).

In the case of the *time-independent learning model*, one can combine elements from classroom teaching with the temporal flexibility of the correspondence school. The individual student studies at home or at his place of work, from where there is a continual dialogue with the teacher and with the other students.

Typically this model employs a computer conference system, communication being mediated technically via a modem which is connected between the telephone and the student's personal computer.

In Denmark, the distance learning dimension, where students work on their own or in groups, is normally combined with classroom teaching in the form of a limited number of weekend or Saturday seminars per term.

The model is well suited to time-independent learning. Weekend seminars aside, it is independent of distance. In a Danish context the time-independent learning model is not, however, particularly flexible when it comes to the starting date and variations in study load during the course.

In the *simultaneously-distributed learning model* students can see and hear their teacher. They can also carry on a dialogue with a teacher when studying either individually or in groups. Technically the model builds on communication by satellite, cable television or by video conferencing.

The model offers the opportunity to link a teacher in a classroom or studio to one or more classrooms at a number of geographical sites.

Of the scenarios described in the report, the simultaneously-distributed learning model is the one which is closest to the traditional teaching mode. For this reason neither the student nor the teacher roles are significantly different from those of traditional provisions.

The model requires that teaching takes place at dates and times which have been agreed in advance. The model is good at overcoming the barrier of distance and is therefore well-suited when it comes to serving thinly populated areas with a few, small institutions where it is difficult to assure reasonable class-sizes. By co-ordinating and combining the teaching of small classes, the range of courses from which the students can choose can be broadened. Furthermore, it is well-suited as a means of promoting specialisation among educational institutions in various parts of the country, and for the education and training of those involved in research.

As the equipment used -- typically video conferencing -- is still relatively expensive, study normally takes place at an educational institution or at the student's place of work.

In the last scenario -- *the independent study model* -- the student, in principle, works alone with the subject matter in a predetermined sequence of modules. The student also works at his own pace, and he must be able to find answers to all his questions in the study package. As the last condition is difficult to fulfil, in practice the model is frequently supplemented with the option of counsellor support at a study centre, or networked counselling via electronic mail.

Breakthroughs with regard to video-discs and CD-ROM technology leading to a rapidly increasing support of high quality material for independent study can be expected in the coming years. As the number of units sold in the international market will be high, the price of independent study packages can be expected to drop significantly.

In principle the model can operate with unlimited class quotients. In practice, however, it is often the case in Denmark that independent study material is combined with traditional teaching. In these delivery modes, the teacher role changes into that of a consultant; the teacher becomes a human resource, to whom the students can turn as and when they wish.

The follow-up of the report

The committee's report was submitted to the government in June 1993 and was well received. Many of the conclusions and recommendations in the report have been adopted and are currently being implemented as part of a major plan to help educational institutions adopt new delivery systems on a broad scale as a part of the delivery systems both for young people and for adults. The National Centre of Technology-supported Learning has recently been established on a non-permanent basis as an independent agency under the Ministry of Education. It is to work as the national knowledge and resource centre to help institutions with the transition to alternative modes of delivery. From 1994 to 1999 the centre is also to administer funds made available by government for transition. The grants are to be regarded as seed capital.

Whilst the centre's major role is to act as a direct sparring partner with educational institutions, the ministry has initiated its part of the follow up of the report. This work concentrates on a series of analyses on the implications of information technology (IT) for the curriculum, legal frameworks, future teacher roles and their implications for initial and in-service teacher training, a set of problems regarding salary negotiations and agreements (*i.e.* what will a lesson be in the future and what will the consequences of this be for the definition of teacher work load), a range of copyright issues on the use of materials in computers and networks, and finally a series of analyses on future specifications of physical buildings for educational purposes, their distribution and characteristics.

The National Centre became operational in October 1995 and the series of analyses conducted within the ministry are expected to be finished within the next year or two.

Implementing the scenarios

The two cases described in the following sections were both conceived outside the planning and decision-making process on information technology issues described in the previous sections. However, both are easily recognisable as delivery scenarios close to those described in the expert report. The aim will be to describe the specific needs of different user groups, the selection of delivery systems in order to optimise conditions for learning and the educational goals set up for a given provision.

A description will also be provided, from the point of view of the author, of the decision-making process, of major problems encountered, what subsequent consequences the participation in these pilots had for the participating educational institutions and what their future plans are. And it should be repeated here that the institutions participating had almost no prior knowledge and first-hand experience on the introduction of IT-based delivery systems in education.

The two projects that will be described are the project for broadening the range of educational provisions in a remote area (Bornholm) and a nationwide project of in-service training of lecturers at teacher training colleges who are responsible for the education and training of future teachers in much of the school system.

The case of Bornholm will be described in detail, because this project demonstrates how the introduction of IT-based delivery systems has an influence on almost every part of an organisation. The second case of in-service teacher training is, however, no less interesting. Here the use of the delivery system is an important part of the objectives of the course and a long-term means of fulfilling the political plans to establish computer literacy as a major goal in modern education and training.

Case 1 -- Bornholm

Geography and socio-economic background

By Danish standards, Bornholm is a somewhat isolated island in the Baltic, east of Denmark and south of Sweden. The flying time on a scheduled flight is only 30 minutes and the journey by sea takes approximately 8 hours. There are some 45 000 inhabitants and the number of students graduating each year from upper secondary schools, commercial and technical schools and colleges (and thus generally qualified for entry into higher education) is approximately 200. The main sources of employment on the island are fishing, agriculture and food-processing industries, along with tourism.

Opportunities to follow higher education courses on the island were few and far between. For this reason young people aiming at a career requiring a university degree have traditionally had to travel "to the mainland" to study. The socio-economic framework offered few job opportunities for an academic career for those young people from the island who wanted to return. The lack of educational provisions combined with the growing proportion of students getting married and having children before graduating from university both lead to young adults staying on the mainland after graduation. This exacerbated the stagnation and decline of the island economy, which over the last decade had already suffered from diminishing fishing quotas and from falling prices for fish sold at the fishing auctions.

Bornholm thus suffered from net migration and from a growing deficit of knowledge, because, generally speaking, it was difficult to get graduates to apply for jobs on the island. The opportunities for changing career were scarce and spouses moving to the islands often had few opportunities to get a suitable job. Taken together, these factors created great obstacles to the introduction of new kinds of commercial and industrial ventures requiring highly skilled labour on Bornholm.

Education and regional development

In February, 1993 representatives from Bornholm had a meeting with the Danish government, and the government agreed to study the possibility of stimulating the economic development of the island. Work was divided into two phases. The first phase dealt with capital foundation of the island. In March, 1993 a series of proposals was submitted on that issue.

The second phase concentrated on the long-term strengthening of the economic foundation of Bornholm. A major component of the plan was to broaden the range of educational provisions on the island, primarily in higher education. The government report was published in May, 1993. One of the recommendations was that a set of pilot distance education projects should be set up, principally at tertiary level. The argument was that the number of students would be too small to broaden the range of new, traditionally-delivered courses within an acceptable economic framework. According to the government report, distance education courses were to be ready for admissions in August, 1994, so the whole running-in period was about one year.

Delivery systems

As was previously mentioned, Denmark has virtually no tradition of education at a distance. The best-known model of the three mentioned in the expert report was the time-independent learning model. It had been used successfully in a number of cases for both degree and non-degree courses, but all on a part-time basis in order to cater for adult students with jobs and families. The model used normally required that study material be prepared in advance and mailed to the students. The conference system was consequently used mainly for teacher support and for E-mailing student work. There had also been some experiences with the independent study model -- at that time mostly in the form of CBT programmes but also interactive courses based on videodiscs.

In both cases, course modules were typically short (two to three days) or were taken on a part-time basis. But the goal in the Bornholm case was to offer higher education courses consisting of 1-5 years of full-time study leading to the same degrees as in the rest of the country. Thus the political and legal requirement that distance education should only be considered as an alternative mode of delivery for normal credit courses offered by the same educational institutions was to be field-tested here for the first time.

Not only was there limited prior experience with distance education in Denmark; the few distance education courses based on the time-independent learning and the independent study models that had been available had generally been organised by private companies. Experience in delivering distance education was almost non-existent among the educational institutions which were to function as the educational suppliers for students on Bornholm wishing to follow tertiary courses on the island a year later.

The Ministry of Education came to the conclusion that the combination of limited time and the delivery institutions' lack of experience in course development definitely ruled out the time-independent study model based on computer conferencing and the independent study model based on interactive learning programmes. The development of a huge range of programmes for such a small target group as in the case of Bornholm was also ruled out because of the development costs. A fourth issue was that courses offered were to be as similar as possible to traditional provisions so that students would easily be able to transfer to another institution if that became necessary, or if they wanted to transfer for personal reasons.

These were some of the elements in the analysis that lead to the conclusion that in the case of Bornholm, the second model in the government report (simultaneously-distributed learning model, or just distributed learning) would be the most appropriate. (One should note that the government report had not been published when the decision regarding Bornholm had to be taken. Draft proposals for the proposed educational provisions were known to the ministry which also provided the secretariat of the expert committee drafting the expert report.)

The decision taken was that the backbone of the delivery model was to be point-to-point two-way video using ISDN as the carrier. In order to ensure that the types of teaching available were as close as possible to those the teachers in the project were familiar with, the extended classroom model was chosen, *i.e.* the delivery institution provides a "normal" lesson to a class in its own institution in which a "satellite" class on Bornholm takes part by means of video conferencing. The economic thinking behind the model is that, in the future, the additional revenue in the form of "taximeter" capitation grants from central government for students in the satellite class would cover running costs, including the transmission costs and maintenance of the equipment. In the specific case of Bornholm, however, the government decided to buy the equipment for the participating institutions and install it free of charge.

The selection of courses

The next phase was to select the courses that were to be offered to Bornholm. The ministry asked representatives from the island to provide a short list of their requirements. In principle, choices could be made from courses offered by institutions anywhere in Denmark. The ministry would then negotiate with delivery institution(s) and would enter into contractual agreements with them. It was expected that the short-list would consist primarily of popular tertiary degree courses in the humanities and law, so that it would be possible to find one university which could be contracted to act as the delivery institution.

The range of requirements turned out to be far more wide-ranging, and covered a wide area of degree courses at different levels. Consequently, the ministry had to negotiate with a much broader group of institutions. At one end, the courses requested were for adult education single subject courses at AVU and HF level (these are the two general upper secondary education provisions for adults provided by the VUCs, the adult education centres). Other courses requested included the "datamatiker" course (a non-university diploma course in advanced computer science provided by colleges of commerce) and the HD course (a diploma course in economics provided by the schools of economics and business administration at tertiary level). To fulfil these wishes meant that the organisation was much more complex than had been anticipated. Planning of the courses to be offered involved many educational institutions with a variety of academic profiles and cultures, and only one year was available until the first students were to enrol and start on their courses.

Business as usual? Pairing delivery and host institutions

The ministry felt that it was crucial to offer students study conditions which were as close as possible to those of "normal" tertiary or adult education provisions. For this reason, learning sites on Bornholm were to be ordinary educational institutions where the student would have access to all normal facilities such as a library, canteen, other students, sports facilities and the like.

It was also a prerequisite for the ministry that the delivery institution was to retain its full academic responsibilities, for instance for the selection of students, choice of teachers, curriculum development and evaluation. As a consequence of this principle it followed that the capitation grants would go in full to the delivery institution. It was then up to the delivery institution to agree with the host institution how the capitation grant was to be split, depending on the costs at both institutions.

The host institutions chosen on Bornholm were Bornholm Erhvervsskole (a technical school and college of commerce) for the datamatiker education and VUC-Bornholm for the AVU and HF courses. In these cases, courses were offered in what could be termed their natural environment. The situation for the HA/HD courses was different. Handelshøjskolen i København (the Copenhagen School of Economics and Business Administration) already offered some of their HA/HD courses on the island (also as part of the government plan) with Bornholms Erhvervsskole acting as host. Lectures and the tutorials were given on the island by local tutors paid by the school or by lecturers travelling from Copenhagen to Bornholm on a weekly basis. Video-conferencing would in this case be used for lectures and tutorials where it was almost impossible either to hire local tutors or to send teachers to the island because of scarcity of qualified staff. It would also be used for the second part of the HD course where it is possible to specialise in a variety of fields. Students would have at least one field that could be followed on the island. (All other fields would still require students to travel to the mainland.)

The Department of Economic Affairs in the Ministry of Education was responsible for the whole pilot project in close collaboration with departments for vocational, tertiary and adult education. It involved 4 different departments at the ministry in addition to the computer department for technical issues, for instance negotiations on hardware and the sector network (to be described later). The sector departments were asked to find suitable delivery institutions. They suggested Lyngby Uddannelsescenter (a school and college of commerce), VUC-Aalborg and the Copenhagen School of Economics and Business Administration, as mentioned above.

Management involvement

The set-up with delivery and host institutions and the very different working cultures that exist in the various educational sectors involved in the pilot meant that from the very start it was crucial to involve senior management at the institutions in question. As regards the VUC centres it also involved the counties of Nordjylland and Bornholm, the authorities responsible for the VUC centres. This was why at the end of 1993 senior staff from all parties involved with instruction and administration participated in a meeting at the ministry to decide the structure of the pilot. A number of the issues mentioned above were of course raised and even though few of the participants were conversant with the details of video conferencing and the concept of distributed learning, all agreed to embark on the pilot. The ministry made it clear that it wanted binding contracts with the delivery institutions for the test period. It was also made clear that an intake of students each year was required, and that the aim was to have the system running smoothly when the pilot period was over in the summer of 1997. This also meant that each delivery institution would have the sole financial responsibility for the students already enrolled when the pilot period was over.

It was felt important to involve administrative personnel from the very start and also in the steps which followed. A session was held in the spring of 1994 for the whole group (including senior officials from the ministry). It was a full one-day course including demonstrations of video conferencing systems and of the use of Lotus Notes applications for collaborative working. Desk-top video was also demonstrated.

The overall organisational structure

As has been described earlier, a number of very different institutions and agencies were involved. The ministry therefore decided to contract the Danish Technological Institute (DTI) as project managers for the whole pilot period. This institution has some experience with video conferencing and had participated in a number of EU-projects in that area. The contract stipulated that they were to be the contact point for the institutions involved, were to help design the classrooms, assist in organisational matters and they were also to provide the necessary training to all those involved, again including administrative staff. They were also to provide the secretariat for the steering committee which consisted of three officials from the ministry and two from the "users" on Bornholm. The delivery institutions were thus not involved in the overall management of the project. Instead, one or two-day seminars with all actors involved in the project were to be organised to discuss and share problems and solutions.

Hardware, pedagogy and technical functionality

In parallel, in the spring of 1994, the steering committee selected the hardware suppliers. Two different suppliers were chosen. The two VUC-centres were each provided with set of video conferencing equipment bought from one supplier, and four sets were purchased from the other company, two sets for Bornholms Erhvervsskole, one for Lyngby uddannelsescenter and one for the Copenhagen School of Economics and Business Administration.

As mentioned earlier, none of the participating institutions had any experience in the use of video conferencing for educational purposes. So in the late spring of 1994 a two-day course was organised by DTI at Copenhagen Business School, again with the participation of senior administrative staff and officials from the Ministry of Education. It became evident that for many of the participants, the concept of detailed, advance planning of every lecture and also the strict demands of long-term planning of course delivery for weeks or months was somewhat vague. Such an approach was felt by the institutions to be somewhat abstract and not recognisable from their planning of traditional course delivery.

The fact that the video conferencing equipment had not yet been installed at the institutions involved was a major problem. This contributed to the feeling of an abstract discussion. The participants were provided with a considerable amount of printed materials discussing in general terms the pedagogy and the technical problems of this kind of course delivery. There was a risk of alienating the participants in the project even before the pilot had started, so a decision was taken to incorporate the ensuing sessions of in-service training as an integral part of the planning and development process as and when the project management and the participants felt it necessary.

It should be evident that the collaboration between the project management and the institutions were very close during that period. (At a later stage when the equipment was in operation, the project management chose to support in-service training with monthly meetings with the institutions using the video conferencing system, but for obvious reasons this was not possible to begin with.) A newsletter was produced by the project management in which problems and solutions were discussed. This newsletter was distributed to all participants in order to engender a team spirit and also to spread information and encourage good practice as quickly as possible.

The courses

The courses planned were very different from each other both in terms of their content and their enrolments. The courses for the first year were as follows:

VUC-centres (general adult education)
AVU-level: philosophy
Lectures: every Monday and Wednesday from 14.50-17.00
Number of students: 12 at VUC Aalborg and 14 at VUC Bornholm

HF-level: mathematics
Lectures: every Tuesday and Thursday 19.30 -- 21.55
Number of students: 12 students at VUC Aalborg and 11 students at VUC Bornholm

HA/HD: Accountancy
Lectures: every Monday and Wednesday from 12.00 - 14.00
Number of students: 250 at the Copenhagen School of Economics and Business Administration and 11 at Bornholms Erhvervsskole

Datamatiker: Diploma courses in advanced computer science
Lectures: 5 hours of lectures and tutorials a day, Monday to Friday
380 lectures/tutorials per term.

All are degree courses leading to nationally recognised certificates. Students can apply for study grants if they meet certain conditions.

As can be seen, the three types of courses were very different from each other. This was to have implications for classroom design, for educational methodology and certainly in the social area, where the opportunities for interaction were quite different.

The datamatiker diploma is a 2 ¼ year, full-time degree course with a very heavy load of lessons and tutorials. Because of the limited period before the term was due to start, the ministry and Lyngby Uddannelsescenter decided that this diploma course should be postponed for six months; the first class was to start in February, 1995. In its place, in the autumn of 1994 Lyngby Uddannelsescenter held a course in office automation with a total of 60 lectures, held every Monday and Wednesday from 15.00-17.00. The instructors were the group of teachers from Lyngby Uddannelsescenter who were to run the datamatiker diploma course from February, 1995. The students were fellow teachers at Bornholms Erhvervsskole. This gave the teachers a golden opportunity to practice. The problem was that the teachers in Lyngby did not have a class in the lecture room as would normally be the case. The other problem was that the student population consisted of their peers whose behaviour might differ from that of normal students.

Pedagogy and interaction

In January 1995, a one-day seminar was organised in which all those involved (teachers, the heads of the institutions, officials from the ministry, representatives from the telephone company and from the hardware suppliers) discussed the results of the first six months.

In the philosophy course, the aim was to have an interactive educational environment in which the two groups interacted as one class, doing group work with participants at both sites. It was also considered crucial that the debate and dialogue be fully interactive. The teacher of the course felt that this had been a success. She had visited the class at Bornholm before the course started. The groups from both sites had been on a joint day trip to Copenhagen. The social structure of both groups functioned well, and there were many activities in Aalborg or on Bornholm.

She felt that more variety in each lesson was necessary. Each lesson should consist of shorter modules, media (video, audio, text) should be more tightly integrated, students should be given more assignments than usual, there should be more group work transcending the two sites and her own language should be varied more. She also found the lack of eye contact with the students to be a serious problem.

The major technical problem (of which there were many!) was poor sound quality. This was a problem common to all groups and was felt to have disastrous educational consequences. In the philosophy course, it often ruined the discussion because comments from the other site were often overheard. It was also evident that poor sound puts real pressure on the instructor during a lecture as he or she has to constantly monitor what had been said—and what had not! Body language was lost because of the equipment, so for instance jokes were often not understood on Bornholm, again compounding the feeling of not really being in the classroom with the teacher! But it was tolerated by the students from Bornholm because they realised that this probably was their only opportunity of taking this course.

All in all, the conclusion was that this course had been successful. The drop-out rate had been two out of 12 at VUC-Aalborg and three out of 14 on Bornholm. This was quite satisfactory. All the remaining students at Aalborg took the final examination in December 1994 and so did nine of the remaining eleven on Bornholm.

The mathematics course had a different outcome. To begin with there were 12 students at VUC Aalborg and eleven students at VUC Bornholm. This was a two-term course and the students therefore had to sit for their examinations in the summer of 1995. After the autumn term in 1994, seven of the 12 students had dropped out in Aalborg and four out of eleven on Bornholm. This was a higher drop-out rate than normal. It is interesting to note that the drop-out rate was significantly higher in the class where the teacher was physically present that at the remote site. Many of pedagogical problems were the same as had been encountered by the philosophy course: the need to split the lecture up in small modules, to increase the variation in teaching styles, to change the teacher/student interaction and to give the students a more active role in the class, including the presentation of mathematical problems and solutions to the others. It was only two and a half months into the course that the teacher discovered that the major problem was not the technology but presumably the level of the course. For many of the students the level was simply far too high. Instead of admitting that "this course is too difficult for me to follow", the mode of delivery was an excellent excuse for dropping out. The teacher also felt that if this had been a normal class, then he would have discovered the problem earlier in the term and would perhaps have been able to provide extra individual support for the students experiencing problems with the level of course.

On this course, the drop-out rate after the first term was higher than usual. When the class sat for the final examination in June 1995, four of the remaining five students in Aalborg took and passed the final examination (33 per cent of the total group). On Bornholm, six of the seven remaining students entered and passed the final examination. The examination results of both groups were very good.

The course in accountancy delivered by the Copenhagen School of Economics and Business Administration was just one course of a full-time degree (two full calendar years. This course is a third term course). The alternative mode of delivery was chosen because of the difficulty of offering the course locally on Bornholm because of the lack of qualified staff on the island. The satellite class on Bornholm consisted of eleven students. Getting them to study with 250 students in a lecture hall at the other site certainly created problems.

Only the lectures were delivered in this way. Tutorials were conducted locally (36 hours). It goes without saying that the interaction between the two classes came very close to being non-existent. The students could not see each other, but the teacher was of course in two-way audio and video contact with the students on Bornholm.

The teachers insisted on using their traditional overheads in the lecture hall and did not use the document camera for this purpose. They wanted to concentrate on their lecture and did not really use and fully exploit the technology (the overheads were larger than the maximum size for use under the document camera). Instead the students on Bornholm had to use the billboard camera themselves via the remote control and in this way try to read the overheads shown in the lecture hall. They did not even receive an advance print-out of the overheads because of the "not-invented-here syndrome". No wonder that they complained of head and backaches and of difficulties in viewing. They also found it extremely tiring to sit and watch a double lecture given this way; they really felt lost and forgotten.

Nevertheless, motivation was very high. The attendance rate was between 90-100 per cent and ten of the eleven students passed the final examination!

As mentioned earlier, the start of the diploma course in advanced computer science offered by Lyngby Uddannelsescenter was postponed six months until the beginning of February, 1995 because of the need for more thorough planning. The technical set-up was far more complex than in the other parts of the project because the technology here is also an integrated part of the course itself. Both teachers and students need to demonstrate to each other what is on their computer screen. So the monitor provides direct demonstrations from the computer and teachers can, figuratively speaking, "look over the shoulder" of their students and see what they are doing on their own computer.

The courses were very varied (necessarily so with five classes every day) and included discussion, tutorials, group work and individual assignments and last but not least, lectures. As is the case in many other mathematically or technically-oriented courses, flip-overs are used intensively, and so the classroom has three flip-overs and for this reason a rather sophisticated camera set-up.

The course started in February, 1995 and the class initially consisted of 17 students at the Lyngby site (where the teacher was located) and 12 students at the Bornholm site. One student at both sites never showed up six of the 16 who started in Lyngby dropped out before the final examination at the end of the first term. Of the ten who sat the examination, seven passed. The class on Bornholm was more persistent. Only two of eleven who started dropped out before the examination. However, of the nine who sat for the examination only five passed. Compared with a parallel class in Lyngby attending the same course delivered as traditional, face-to-face tuition the pass rate was lower. 60 per cent of the traditional class passed, while in the video conferencing class the pass rate was 41 per cent in Lyngby and 42 per cent on Bornholm. As regards the examination results, the mean grade was slightly higher in the traditional class than in the video conferencing class(es). The mean grade at the Bornholm site was slightly higher than that of the Lyngby site.

The general impression after the first term of full-scale tuition was that the motivation of both the teachers and the students was very high. There had been many technical problems but they had been solved. Poor sound quality was also a major problem which also restricted social interactions between students at the two sites. The general impression of the school administration is that the project has helped improve the quality of the diploma course both in the traditional and the video conferencing mode of delivery, and lecturers have been more consistent in providing handouts to the students. The overheads used in this course are all delivered by means of a computer slide-show programme (Power Point) enabling them to be shown on the monitor at both ends with the same quality. Overheads are sent to the students by computer before the lecture starts, so it is possible to take notes on the handouts during the lecture. This approach is highly appreciated by the students.

The autumn term, 1995

In the term which has just finished, the VUCs offered four different courses:

- Advanced Mathematics (not implemented because there were too few enrolments)
- Philosophy (Bornholm: 16 students, Aalborg 5 Students)
- Russian (Bornholm 11 students, Aalborg 14 students)
- Religion (Bornholm 13 students, Aalborg 3 students). This course is delivered from Bornholm to Aalborg.

The datamatiker diploma course has finished its second term. The results are not yet known.

The Copenhagen School of Economics and Business Administration is again offering the accountancy course (nine students). The full diploma course in advanced accountancy is now being offered (eight students). The lectures and tutorials are given on two weekdays with four hours each day (the diploma course takes two years on a part-time basis in the form of evening classes). For the full diploma course of advanced accountancy, the number of students at the Copenhagen site is considerable lower than for the general course (approximately 40 students). The Copenhagen School has therefore designed and furnished another video conference-based classroom better suited for smaller classes than the 250-seat lecture theatre. The school has also made a major effort to improve the educational methodology of video conferencing sessions. All overheads are now made using a slide show application -- an evident improvement.

Technical problems in the autumn of 1995 were far more serious than in the first year of the project. The problems with poor sound quality and connection cut-off (particularly at the beginning of the term) have increased thus totally ruining lectures and course planning. (The transmission rate is 384 kilobit per second. This requires three ISDN lines each with two 64 kilobit B-channels. The connection instability is due in part to the ISDN transmission technology, as the three lines are not necessarily routed through the same digital exchanges. If this is the case, the transmissions do not arrive at the same time and there are synchronisation problems at the receiving end. If such delays persist, the connection cuts off.)

Combining video conferencing with other delivery systems

The technical set-up in Lyngby has shown its robustness in daily use. The lectures are automatically recorded on video and in the event of communication failure the cassette is sent by plane to Bornholm in the afternoon, so that the students have the opportunity to see the lecture the next day before the class starts. The teachers can easily change tutorials, assignments and so on for the Bornholm class, because of the sophisticated set up for collaborative working with computers described above.

In theory, this solution could also have been adopted by all the other institutions involved in the project. They are all connected to the national computer network for educational institutions. This network is being implemented in a number of steps and all the institutions in the Bornholm project were connected at an early stage because of this project. The network is not yet powerful enough to support live video and sound, but is has enough bandwidth for normal data transmission. The use of Lotus Notes could be a powerful element in future projects with extended classrooms because of the capability to differentiate and vary the delivery format.

Although the network is physically in place, only the datamatiker course makes use of it. This is partly due to the lack of a support structure covering the technical and educational aspects of using the network for the main sectors of the education system. At the time of writing (December 1995) the support structure is currently being planning, but final decisions have yet to be taken and thus the support structure is not yet in place for general support in the Bornholm pilot. Institutions do not know where to go for guidance and advice and the network is therefore not used effectively in the project. This situation is regrettable and the Lotus Notes platform is sorely missed by the institutions involved. There seems to be no doubt that within a few years the Bornholm delivery model will be much more diversified and probably more efficient.

Whither the project?

The project ends in July, 1997 and is therefore at the half-way stage. An independent evaluation committee has just been appointed. In particular it is to analyse the educational year 1995/96: the technologies chosen, educational methodology, student and teacher satisfaction, academic achievements, and organisational problems encountered. A comparative economic analysis will be made in which this alternative mode of delivery will be compared with both traditional face-to-face tuition and the option in which an institution on the mainland sends teachers to the island and also hires local tutors. The overall impression to date is that there are still too many technical problems, in particular with the stability of the ISDN equipment. The lack of a single video conferencing standard creates problems and limits flexibility. Most of the teachers involved feel that the intensive use of the video conferencing should be reduced and combined with more activities based on computer conferencing and on students studying on their own with (and without) computers. Student satisfaction with the courses on Bornholm still leaves much to be desired, and most of them indicate that they would have preferred traditional courses on Bornholm had it been feasible from a financial viewpoint. Students do, however, recognise that they have to chose between this delivery mode and one involving travel to and study on the mainland.

Impact on the participating institutions

In general terms, the impact of this project on the institutions involved and on other institutions in the country has been considerable. All the institutions involved have made use of the experience gained within their own organisation.

Lyngby Uddannelsescenter already had a very powerful IT-environment prior to this pilot. This experience has given them the impetus to take part in serious planning initiatives involving international co-operation and the centre now offers highly specialised courses in collaboration with centres of excellence worldwide.

The Copenhagen School of Economics and Business Administration has also worked along the same lines on collaboration with experts worldwide. Their plans are even more far-reaching. The school now plans to transform itself into a learning centre, connecting students and teachers in a network and giving students access to library facilities, to courses and to study material, access to administration and information and of course giving all students full access to the Internet. As for the teachers, the courses in educational methodology have been intensified and technology-supported delivery techniques have been included.

VUC Aalborg has also intensified the use of technology as a part of its delivery system. There are plans to offer a university degree in psychology on Bornholm using the equipment at the two VUCs.

Bornholms Erhvervsskole has just built a new wing at the school devoted to modern delivery systems and well-equipped with computers. The school will thus have the opportunity of hosting many different courses -- many of which are degree courses at universities -- offered to the population of Bornholm by outside institutions. Among initiatives currently at the planning stage are a university degree course in mathematics offered by the University of Aarhus and a degree in new media offered by the University of Roskilde.

Delivery systems tailored to the target population

The delivery system chosen for the Bornholm project is still a high-end solution as regards hardware costs. The course development costs are, however, relatively low in many cases. A comparative economic analysis (as part of the evaluation which is to follow) will show whether under normal circumstances it is a cost-effective mode of delivery when the institutions are free to chose to deliver specific courses on their curriculum in a distributed manner. In the case of Bornholm, the most interesting part of the economic analysis will be the comparison with courses delivered from the mainland where the provision consists of local tutors and lecturers commuting from Copenhagen.

In the long term, when prices for hardware and transmission costs have reached a level appropriate to a mass market, video conferencing or desk-top video will probably be an integral part of the delivery system of most educational institutions. The advantage is the superficial similarity with well-known technologies and the opportunity for teachers accustomed primarily to face-to-face tuition to gradually adapt their teaching methods to this medium, guided by their fellow teachers.

It will probably be an advantage to combine this delivery system with the intensive use of computer conferences for special units of the courses. This will add variety and additional flexibility as regards the educational methodology used. It will thus support both students who prefer learning in a classroom context and students who prefer the text-based dialogue with its built in qualities of flexibility and the freedom of choice to chose their own pace of study.

Courses primarily based on computer conferencing are often considered to favour the well-educated who are used to working on their own in a text-based context. The courses demand high motivation and discipline on the part of the participants, but they also offer the flexibility often needed in particular by students on part-time courses who also have full-time jobs. The conference facilities offer a social context for specialists scattered all over the country allowing them to interact with colleagues over long periods. The long-term effects of this kind of interaction have yet to be studied. But it stands to reason, that these kinds of personal networks will be able to provide support to lecturers working in small institutions where there are often only one or two lecturers for a given subject.

Network-based courses can operate with far higher student numbers than video conferencing. This is therefore a good solution in situations where there is a need to update the qualifications of a substantial proportion of a professional body. The second case will describe a project of that type. The delivery mode of this course is well-known all over the world. As described above, the Danish version of the model often operates with a combination of computer conferencing and face-to-face tuition, self-study and discussions.

Case 2 -- In-service courses for lecturers at teacher training colleges

The institutional framework

Denmark has 18 teacher training colleges scattered all over the country. They all offer a four-year (non research-based) degree course for those who teach in the *Folkeskole*, year 1-10 of primary and lower secondary education. There are some 850 lecturers at these colleges. Most of them have a master's degree in one or two subjects, and a certain number also have a teacher's degree as their first tertiary degree supplemented by part-time studies leading to a master's degree in one specific subject. This group is thus responsible for the school teachers of tomorrow and their qualifications. Individual colleges have a some degree of freedom to make their own mark on the courses delivered. But the colleges work under the provisions of the same Teacher Training Act, and the aim of all colleges is to train new teachers for the *Folkeskole*.

Lack of computer literacy in teacher training colleges

As was mentioned earlier, one of the liveliest public debates in 1995 was the lack of computers in schools and the challenge of imparting genuine computer literacy to young pupils before they go on to higher education or to vocational training and the labour market. To many participants in the debate, the key issue is not the lack of computers, but the teacher's own lack of computer literacy. The *Folkeskole* Act from January, 1995 stipulates that IT is to be an integral part of all subjects taught in primary and lower secondary education.

This requires intensive in-service training for the teachers already working in the *Folkeskole*, and many initiatives have been taken by both the ministry and by the local authorities responsible for primary and lower secondary education to deal with the matter. The debate has also focused on the situation in teacher training colleges, where students (and recent graduates) complain of the lack of training in the integration of IT in school subjects at the *Folkeskole*.

To cope with this situation, a nationwide teacher-training initiative is under development, using the national sector network available to all educational institutions. This network is currently being implemented and the teacher training colleges are all connected. This particular sector network is only one part of a series of initiatives regarding networks and telecommunication. The following section gives a brief outline of the status of the IT initiative and plans for the immediate future.

Network infrastructure and services

Low level services

In Denmark the network infrastructure consists primarily of regulated telecom services such as low cost Internet access using high speed dial-up connections (28.8 Kbps). Nodes for dial-up connection are accessible throughout the country usually at local telephone tariffs.

ISDN has been in use for several years in Denmark, although its performance is still less than perfect, and is being used as an alternative to dial-up connection and for backup purposes. Internet providers and network operators are conducting pilot projects with ISDN (64 Kbps) access, but in most cases work is still at the piloting phase.

X.25 is available throughout the country and can be regarded as a tested solution for high quality data networks. X.25 is currently competing with the new Frame Relay service, which offers a wider spectrum of bandwidths and a better performance, as well as lower telecom rates. Frame Relay is available in most parts of the country and offers transmission rates from 64 Kbps to 2 Mbps. Frame Relay services are still too expensive for general educational use.

As a consequence of the nascent deregulation of services (ONP), new services and providers are appearing on in the market: cable TV operators offering bandwidth, major enterprises reselling spare capacity and municipalities setting up their own fibre-optic networks and reselling excess capacity. Typically bandwidths of 1 Mbps or more are on offer.

High level services

The Danish government has adopted a national information initiative called Info 2000 with two important tasks in the educational field:

- The Ministry of Education is building an educational network for all its institutions from primary schools to universities with a capacity sufficient to allow surfing on the World Wide Web, and enough to embark on multimedia tasks (64 Kbps-2 Mbps). More than 200 institutions are now connected. The plan is to have all connected by the year 2000. At that stage some 3 000 institutions will be linked to the network.

- The Ministry of Research and the Ministry of Education have joined forces to establish a new research network based on the old DENet in Denmark. It will cater for all public and private organisations concerned with scientific research. Implementation will take place from 1996-97. The network will offer bandwidths between 2 Mbps and 34 Mbps and help Danish research network activities to maintain a leading position internationally. The network will be integrated with the educational network.

Using the network for education

Let us now return to the case of in-service training of lecturers at teacher training colleges. In the first phase, the goal of the project is to make the lecturers skilled users of personal computers and in the second phase to offer courses on the didactics of integrating the use of IT into the various school subjects. By using computers and networks as the delivery system, the lecturers are obliged to work with the technology in order to follow the course. It is thus both the objective and the means of the course.

Since 1995, in-service training of lecturers has been decentralised and government funding for this purpose is now part of central government grants to the individual colleges. The colleges have set up an organisation to which they all pay a share of the administrative costs. This organisation is responsible for the annual in-service training programme, in some cases in collaboration with professional bodies for the various subjects.

In this computer literacy programme a wide range of partners are involved in the various fields. The partners are:

- The Royal Danish School of Educational Studies;
- KommuneData (the computer centre of the local authorities);
- UNIC (a national centre responsible for the research network);
- ORFEUS (a publicly supported producer of educational software);
- The Ministry of Education (SKoDa on-line databases accessible to schools);
- Seminariernes Brugerservicecenter (the computer and network support centre of the teacher training colleges).

In contrast to the Bornholm project, the initiative for this project came from the field and not from government.

The course structure

Training consists of a non-credit course which is usually the case for in-service training. The course will consist of three modules. The first module aims to make the students skilled IT users. They learn to use word processors, spreadsheets, databases and external communication. According to the course programme, the course runs for eight weeks with an estimated workload of seven working days. The students study on PCs and communicate via networks during the course. The course starts with a one-day seminar on a regional basis at which all the students meet their teachers. Here the project, the aims, and the study facilities in the form of flexible learning via networks, new to most of the participants, are introduced.

The course requires that each student has access to a computer (the same throughout the course) either at the college or at home. The minimum configuration is an IBM compatible personal computer with a 386 processor or better, and at least 4 MB RAM -- preferably more! The application requires 10 MB of empty disk space on the hard disk. The network connection from home takes place via modem. If the lecturer works from the college, then the sector network is used.

The examples used in the course relate to the lecturer's daily working situation. The network is used for communication. The conferences are divided into informal, social networked cafes and a compartment for official announcements. There is also a range of conferences based on the subject matter in question and local support at the college in the form of contact persons skilled in the use of computers who help the students install the programmes and provide technical support during the course.

The planning of the first module started in the autumn of 1994. The first course was offered in the spring of 1995. 120 lecturers out of a total of 850 enrolled on the course. After the start-up seminar, tuition during the subsequent 6-7 weeks took the form of network-based distance education. After that, the students again assembled on a regional basis for a mid-term seminar, during which the first part of the course was evaluated. Participants were also taught to use on-line services, the use of news databases and the World Wide Web. After the seminar, the second part of the course took place in the same delivery mode as the first part. The students were divided into 3 groups for the seminars. The networked conferences included all 120 participants. The demand for the course was so high that the course has been repeated in the autumn of 1995.

The second module was planned in the spring and summer of 1995. The goal of the second module is to use and integrate IT in individual subjects. During this part of the course, the students are grouped by subject. The following subjects are available:

- Danish
- Foreign languages
- Mathematics
- Science and Technology
- Pedagogy / psychology
- Social science / history / religion
- Arts
- Music

This course started in October and November 1995 with joint seminars before the network-based tuition, and is still running. In this module, the students are divided into groups according to the subject they teach. The work load of this module is also expected to be seven working days. The delivery set-up is the same as for the first module. Some 200 lecturers have enrolled in this course.

The third module is now being planned. The goal of this module will be the didactics of technology-supported teaching and learning styles.

The outcome?

The course is still underway, but success in terms of the interest shown by lecturers wishing to enrol for the course is remarkable. A detailed analysis of the cohort of lecturers following the first and second module still has to be made. It is, however, the general impression that the first module attracted middle-aged lecturers who had not grown up with computers. The demographic profile of the second module also includes younger lecturers who are already IT users. It remains to be seen how and to what degree this will affect the teaching style at the teacher training colleges. But the upgrading of the lecturer's IT qualifications on a broad basis is of course a prerequisite for change in this field.

The planning approach in this case seems very flexible and efficient. The delivery system, with a combination of seminars and distance education via networks, is flexible and allows for adjustments to be made to the course during delivery to optimise the quality and to meet the specific needs of the target group. This is also due to the fact that the course developers also act as tutors and mediators during the course itself.

Conclusion

The two case studies show that the speed of implementing new delivery systems for adults based on IT can be quite high even in countries with almost no tradition in the use of distance education. They both underline the need for integrated actions involving all parties in an institution, including management and administration. They also document the need for substantial technical support during the running-in period, and in the case of Bornholm the disastrous effects on the course when there are technical breakdowns. This justifies the use of well-known and stable technologies for large projects and often a combination of "sunset technologies" rather than relying exclusively on leading-edge solutions.

Much research is still to be done and examples of good practice from all over the world will be a valuable asset to governments planning the next steps in the transition to an information society.

FRANCE -- TÉLÉ-LANGUES
DISTANCE LEARNING FOR LANGUAGE TEACHERS
A distance-training programme for language teachers using authentic audio-visual materials

Background

Using authentic video documents from foreign television is now an integral part of secondary and high-school teaching programmes in France[1]. Although teachers are seeking the proper video-technology training, MAFPEN (PAF)[2] internships and seminars are inundated by an overwhelming number of applicants (almost 700 at the Academy of Versailles for the scholastic year 1992-93).

Organising face-to-face training courses is expensive and means engaging video-technology training staff, preparing classrooms, and requiring teachers to travel long distances, especially for an academy such as that in Versailles whose geographical area is extensive.

In spring 1992, the head of MAFPEN Versailles accepted the LID proposal to develop a new distance-learning plan of action. The size of the Academy of Versailles[3] justified the use of distance-learning and video-to-video training. It also presented the perfect opportunity for universities to test certain hypotheses and challenge the critiques of traditional distance-learning, and thereby pave the way for a new plan of action. Télé-langues was then born, an autonomous training system for foreign language teachers.

Project aims

The training provides foreign language teachers with the skills necessary to analyse video documents, and in turn enables them to select videos from foreign television on their own.

It instils language teachers with a didactic reflex on how to utilise authentic video documents in class in a way which will improve the quality of teaching.

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[1] "The 1995 ministerial directives provided recommendations for the use of VCRs. Teachers are encouraged to adapt films, television programmes and productions to student needs." (Presentation of foreign television by Mr. Legrand, Director of High-school and Secondary Schools of the Ministry of National Education, Médialog No. 8, November 1990.)

[2] MAFPEN: Mission Académique de Formation des Personnels de l'Education Nationale (Academic plan for the training of National Education personnel). PAF: Académique de Formation (Training Academy).

[3] Groups represented include the MAFPEN and the CRDP of Versailles, University of Paris VII.

In the short term it means demystifying VCR use for language teachers, and promoting collaboration between language teachers within the same institution. In the long term, it means changing attitudes towards video use in education.

The Télé-langues project

Up-close training

Teachers enrolled in the training programme are not isolated, but are encouraged to work together with other enrolled teachers in their own school (base group) and are in contact with colleagues from other institutions. It is during these first face-to-face courses when the tutor must stimulate contact between groups from different institutions in order to ensure an ongoing interchange, at least by way of the telematic network, throughout the training period.

Since a large part of training takes place in an institutional setting in order to facilitate group functions, the proposed system must differ and clearly be presented as a tool of immediate practical use by the learning language teacher. It is therefore necessary to illustrate the practical side of theory and know-how which may arise during class without neglecting reflective theory at the same time. The two should become equally attractive so that the enrolled volunteer becomes an active participant.

Flexible arrangement

During the few days of preliminary in-service training, teacher-trainees are advised to prepare themselves to undertake the training programme as active participants. Arranged activities and an *open training area* allow trainees to advance at their own pace and establish lines of communication between training groups. The course programme schedules about 40 hours of work (personal and in groups). A booklet outlines the course layout and its different stages in a way which promotes a non-linear programme structure.

The programme is divided into nine units, called *modules*. A course outline card for each *module* describes the training method to follow, including the use of video cassettes, reference texts, telematic communication through e-mail and asynchronous debate sessions with other groups, tutors and experts. Each *module* includes individual activities, group work with colleagues in the school framework, and real "in-class" practice in the school where the trainee normally teaches.

The EAD system

The stages of group work, telematic communication and video use in class are established as part of the school framework so that groups have access to the necessary materials. The telematic network, for example, must guarantee inter-institutional communication and the means for question and suggestion inter-change between teachers of the same language. It is also through this network that groups may contact their tutors and experts.

Each tutor is responsible for one to five groups, and remains in contact with the groups telematically after having met with them in one of the obligatory face-to-face sessions (two at the most).

Training contents

The course content, which is based on face-to-face training and seminar classes, and on trainee remarks and questions, includes an introduction to the basic elements of television image rhetoric limited -- how to transmit the sense of a video document (since the aim is to use this medium in language courses). A three-stage analysis[4] invites trainees to reflect on the film director's reasons for choosing a certain subject rather than to simply describe a sequence in detail. Beginning with the hypothesis that the director masters a certain television imagery, whose effects can be decoded, makes it possible to identify the messages he/she wishes to communicate to the largest possible audience.

Trainees realise why video is not a simple "extra" for language courses, but rather a necessity. The passage from "language" to "communication" must therefore integrate non-verbal, contextual and situational elements which only video can introduce in the classroom. Video may also facilitate specific language acquisition problems.

The course examines the elements needed to construct a methodology adaptable for a particular class. Training demonstrates that the idea to use a video document determines the criteria for its choice. It is therefore essential to develop pedagogical support inspired by different teaching methods.

Content orientation and limits are sustained by theoretical reflection and by certain hypotheses developed during research on animated images.[5]

Teaching process

In planning the process two important factors must be taken into account:

- teachers already have mental images of learning processes in class, which are not necessarily compatible with distance-learning; and
- that teacher-trainees teach different languages, which must be accounted for when preparing course contents.

Imagining the potential difficulties arising when applying the system in a scholastic institution -- fatigue, impatience, the need for immediate results -- was the next step. Distance learning possibilities were then considered, bearing in mind limitations caused by scarce interaction with trainees. Using modern communication means was essential, without forgetting that trainees were learning how to use the technology. It seemed difficult in an introductory course to count on PCs, when VCR and remote control manipulation fears began to arise.

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[4] See details of various choices in different editions of the collection on self-learning EDAV (Exploitation de Documents Authentiques en Vidéo) edited by the CIEP, 1 avenue Léon Journault, 92 Sevres.

[5] These hypotheses were developed in a thesis on American television series and their use in language teaching (C. Compte, Ph.D., New York University, 1985).

Defining the teaching process was determined by three concerns:

- *psychological*, trying to reassure and convince by emphasising the utility of training and providing trainees with the means to be active participants, and evaluate what they have learned throughout;
- *practical*, organising tasks in such a way that the trainee must hand in work, prepare assignments, reflect on proposals, and exchange information;
- *intellectual*, verifying that the semiotic, linguistic, didactic, and psychological notions were introduced and experimented with in practical exercises.

Télé-langues is presented as action-learning: by putting knowledge to practical use the teacher will progress, will pose other questions and problems, and will in turn propose original solutions.

The method chosen for video training is pragmatic and immediately applicable, and does not involve providing theoretical analysis. It aims to:

- ease direct comprehension by the media language itself, without meta-language intervention;
- propose various development strategies for which the document would be the starting-engine; and
- progress in media rhetoric knowledge, without necessarily making it a goal (except if motivated by the student curiosity and needs).

Télé-langues should not appear as a complete audio-visual training course, but rather as a course targeted at the increased use of authentic documents in language classrooms. For this reason, video training for beginners was considered in different ways:

- Training in use and handling of VCRs.
- Training in the rhetoric of video animated images.
- Training in the pedagogical development of animated images.
- Training teachers in the important didactic developments introduced by in-class video use (changing ways of communication, knowledge evaluation systems, image perception representations and its influence on learning).

The first is the most difficult to operate in a distance-learning framework. Though certainly the most simple and most rapid to resolve, it can equally be passively ignored by teachers if neglected. It is therefore treated in the very first face-to-face course. The difficulties presented by installing video systems in scholastic institutions makes its necessary to train teachers to use different types of VCRs, and to detect and solve simple connection and breakdown problems. Mastering the equipment also requires a certain amount of self-sufficiency so that the teacher may concentrate on class reactions while simultaneously operating the VCR (so that rewinding or sequence-searching pauses do not distract from exercises). Such self-sufficiency comes only with repeated use.

The originality of Télé-langues

Télé-langues distinguishes itself from traditional distance-learning by three characteristics: it seeks to change teachers' attitudes, to content as well as learning processes; to redefine team structures to encourage collaboration in developing the product; and to utilise communication technology for training.

Changing teachers' initial attitude towards video

Introducing the use of video generally poses obvious psychological problems, because it brings about profound changes in how knowledge is transmitted, in teacher-student relationships, and in extra-curricular activities.

Difficulties increase in a distance-learning system which filters an individual's personal doubts and questions and in turn risks creating solid defence mechanisms in students. This type of teaching could solidify student apprehension, and unconscious difficulties and fears, and end in total rejection of the learning process.

Two points are therefore of high priority in this system:

- stimulate motivation, and
- avoid student isolation.

Many approaches were taken, from stimulating curiosity to rational arguments aimed to convince by encouraging students to apply themselves.

Stimulate motivation

A variety of proposals

The system uses different scenarios from one *module* to another in order to avoid routine and conserve and arouse the learner's curiosity and interest. The types and number of activities therefore differ: at times it means studying a document and analysing it in a group situation. It is also possible to read texts aloud followed by discussion and work based on questionnaires, or apply what was learned to a practical setting and draft a critical report which is then presented to colleagues. Certain *modules* select a particular document which teachers will then use to propose other original activities.

Rational arguments

It was necessary throughout the course to avoid giving the impression that video could be a kind of panacea. *Modules* are conceived as zones of practical application aiming primarily to use video documents efficiently in language courses -- but this in turn serves as a support to take the project a step further. Assisted by basic texts composed of articles, teachers may embark on a larger analysis by studying contributions from cognitive psychology and media studies.

Promotion

The advantage of such a course of face-to-face training is already apparent in the high quality of subject presentation. It was the object of group analyses, critiques and proposals -- a level of preparation rarely encountered in face-to-face training.

Using telematic conferences provides each trainee with the opportunity to converse with and pose questions to experts, a specialist interviewed in the "expert video". This is only possible because of the large number of course participants; face-to-face training courses would have such opportunities only occasionally.

For this reasons the three videos selected (three due mainly to the high cost of professional production, which was unavoidable) focus on three types of arguments:

- humour-based promotion, with the appeal of a subject presented in a disastrous manner [video *Futile-Utile* (Pointless-Practical)];
- argument contributed by experts in different fields such as linguistics, psychology, semiotics, pedagogy, and sociology, which together seem to clearly demonstrate the proper use of video in language courses [video *Interviews d'experts* (Expert Interviews)]; and
- commentary on different types of communication which can be incorporated in the introduction of this media in language courses [video *Communication dans la classe* (Communication in Class)].

Encouraging teacher-trainees to apply themselves

Since each *module* encourages trainees to "put into practice" what they have learned, teacher-trainees can immediately judge their own progress or difficulties and share them with others.

Avoiding isolation

Although teachers are at times alone when reading course texts or using video documents in class, the system provides various interchanges:

- with in-school colleagues;
- with colleagues in the field from other institutions;
- with tutors; and
- with participating experts.

System installation team

A system was conceived, inspired by the Canadian experience in particular, combining various experts, experiences and viewpoints, and was formulated in three stages: a nucleus of experts, a development team, and an experimental installation.

The nucleus of experts

In a multidisciplinary environment, a course development team with complementary abilities seemed essential: individuals with good knowledge of distance learning, video systems, language teaching and text editing. Through its investigations, this nucleus was able to assemble a task notebook based on suggestions from academics and school inspectors.

The development team

To consider teaching from the instructor's viewpoint, working teachers were asked to help develop an introductory method to course contents. The programme counts on the identification of these collaborators with future trainees, in order to assure that course contents are presented in the most efficient way possible, given the potentially poor motivation of a teacher suddenly obliged to acquire knowledge about an entire field whose usefulness is not immediately apparent.

The development team consists of two teachers for each of the six training languages: English, German, Spanish, Italian, Portuguese, and Russian. The group's professional heterogeneity corresponds to its targeted public. Some are video-training teachers but who due to lack of time reflect little on their method; others never used video documents in their class and are apprehensive, like future training-graduates, about the potential material problems and transformations the media may have on their teaching methods.

Since May 1992, as it was already done for French courses on Peruvian television,[6] this group was trained by video. Group questions, reactions and suggestions provided a natural selection of topics, goals and activities, and help reveal the motivations and knowledge level of a similar audience.

Utilising communication technologies for training

One of the original and important elements of this experiment is the use of modern technology for rapid communication. Using telematics, cable and the Télé-langues satellite system allows teachers to become acquainted with these technologies without neglecting their studies or missing course contents. They are consequently better prepared to be potential users of satellite transmissions and authentic materials, as well as to exchange questions, suggestions and teaching methods with colleagues.

In this way video training musters its strength. It is not simply a question of learning how to master certain machines or use certain teaching materials, video-training has a built-in auto-critique of its own knowledge transmission method and the role of teachers. Opening up to information from daily life more than ever exposes the class and the professor to the exterior world and other colleagues, and assures that video-teaching does not become the exclusive method, which in the short term due to the time and energy required to selected and prepare materials ends in discouragement. Communication technologies can overcome this problem by promoting rapid interaction.

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[6] Courses diffused on the Peruvian national station from 1970-1980: these courses recorded the highest ratings among the country's cultural broadcasts.

Conclusions

The Télé-langues project responds to and participates in forming a teachers Europe by providing the tools which will allow them to use what technicians have already assembled. Using satellite antennas and cable means that language teachers need no longer depend upon the printed materials of publishers. Language teaching whose goal is communication must adapt to the speed of information diffusion -- this means that what is happening next-door must be better understood in order to communicate. It is not a question of suppressing or ignoring printed materials which necessarily play an important role -- the collection of "authentic materials" increasingly prevalent in publishing catalogues proves it. But why wait for editors to elaborate and publish video documents, selected for their neutrality (so as not to "date" them to quickly), when teachers already have access to a source which they can consult practically the very day it is diffused.

The Télé-langues project entered its experimental phase in March 1994 at the Academy of Versailles, and will be evaluated in 1996 based on more than 800 language teachers. Already an initial impression of tutors in two years of training reveals a rapid attitude change of teachers towards video. Most commented on their acquired proficiency with and enthusiasm towards video use in class. Others appreciated the inter-language training work groups. To their great surprise, teachers found that analysing video documents in different languages proved to be an extremely positive and enriching exercise.

Conclusions and eventual modifications based on the definitive results of the experiment will help refine the system. The high demand for training makes it possible to conceive of transferring acquired know-how to other training situations requiring rapid installation, which the changing world will necessitate more and more.

GERMANY -- MULTIMEDIA SYSTEMS IN CORPORATE TRAINING

by
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Training bodies and methods have seldom been examined so critically as in recent years. This is at least the case in Germany which once was extremely proud of the quality of its training schemes and still has many reasons for being so. The high level of employee training and the success of the German economy continue to reflect the efficiency of a basic and continuing training system which is considered too costly but which, at least in the past, has unquestionably produced excellent results.

The considerable changes in the picture in the last five years become apparent from a re-reading of the material for the international conference which was held in Berlin in the autumn of 1990 to mark the 20th anniversary of the Federal Institute for Vocational Training. At this Conference H.P. Bloßfeld compared a number of vocational training systems. He identified five problem areas in which a training system should give the right answer to the following questions:

- Is there a flexible approach to introducing job-seekers to the occupations of the future?
- Does the system promote individual adaptability?
- Does it provide for a smooth transfer between different types of activity?
- Does it provide career and advancement prospects?
- Is access to it easy?

In connection with the debate in Germany in 1990 on the increased need for skills, he came to the conclusion that the institutional solution to providing a modern type of vocational training had to be based on Germany's dual system rather than on uncertificated on-the-job training or on purely scholastic vocational training. However, he argued that the German system could definitely be improved.

From the current viewpoint, what is important in Bloßfeld's lecture, which was given only five years ago, is not so much the favourable judgement of the German training system as the fact that the challenges and problems at the start of the information age were treated only in outline. The problem areas in the training system listed by Bloßfeld are still as important. Today, however, the problems are much more serious than five years ago and the answers at the start of the information age will be much less certain and more radical than had been expected in his day. A sixth question, whose importance could only be vaguely perceived at that time, has also become increasingly relevant: can a vocational training system provide the required skills on a cost-effective basis?

The funding issue is beginning to overshadow all the others. The terms of the training policy debate have also changed radically within only a few years.[1] We are now confronted with a fundamentally new situation.

In their recommendations to the European Council, major European specialists came to the conclusion that "throughout the world, information and communications technologies are generating a new industrial revolution already as significant and far-reaching as those of the past".[2] Europe "must make a break from policies based on principles which belong to a time before the advent of the information society".[3]

Owing to the pace of change in all sectors of society, it is difficult in a training system to abandon traditional structures and processes, discern new developments, keep up with them and perhaps even prepare for them. It should not be ruled out that the time-honoured German system of vocational training itself will be confronted with unexpected problems, not least because of its success in the past. This applies particularly to the dual system of initial vocational training, whose main advantages (smooth transition between school and working life, skilled labour potential, homogeneous level of qualifications, focus on practical activities, broad basic vocational courses), are tied to a highly structured system that is much more difficult to modify than the continuing training system which is controlled more by the private sector than by government.

Coming back to the problem areas referred to by Bloßfeld, it should be asked what impact the information society has on these areas and whether information technologies can do anything to solve the problems of the information society. Can multimedia systems, for example, help to solve the vocational training problems of the information society?

Booth and Allen rate the potential very high: "Multimedia learning and teaching programmes are already being used very successfully. Using video, audio and graphic information to put over subject matter should lead to improved assimilation of what has been taught and to faster learning. Many specialists expect learning efficiency to be increased by a factor of 3".[4]

The Fraunhofer Institute takes a much more cautious view: "In the discussion on multimedia information and communications technologies, both critics and advocates of multimedia systems agree that the consequences of their extensive use have not been reviewed thoroughly enough. In addition to their influence on the organisation of work, work content and the structure of working time, the trend in future job descriptions and curricula, the time spent on basic and continuing training and the development of the training system must be taken into account. Those who develop and advocate multimedia technologies now see a potential for more flexible and efficient methods of instruction which, with the use of computers, could be a considerable asset precisely in basic and continuing training. Their training possibilities range from the kind of instruction provided by a manual, to back-up for learning methods. How effective this back-up can really be, however, is still an open question, to which conflicting answers will accordingly be given in the debate with educationists, trainers and social scientists".[5]

In its report on the opportunities and challenges in multimedia systems,[6] the Federal Ministry of Education, Science and Technology considers that "multimedia technologies (...) are the unifying and economic mainstay in the emerging information society and an important factor in the solution of global problems. As modern society cannot do without these techniques and services, its only option is to organise them". The need for action is seen particularly with regard to the highly skilled jobs which will be created in the knowledge-intensive services sector, the production of interactive training and recreational programmes, and the reduction in traffic as a result of telecommuting.[7] Neither of the reference texts goes into detail on the importance of information technologies for vocational training.

The European Union has published two texts which in my opinion take an extremely interesting approach to this new technological and economic revolution, without abandoning the European cultural tradition, which of course includes Germany. A White Paper[8] deliberately takes the viewpoint of a European citizen who is confronted with new developments relating to employment and access to it. It gives a comprehensive analysis of the situation and clearly defines the path towards a learning society,[9] which is also the subject of the "European Year of Lifelong Education and Training" scheduled by the European Union and Parliament for 1996. The White Paper refers to the work of the EU's Multimedia Educational Software Task Force.

A paper by the Multimedia Educational Software Task Force[10] briefly describes the situation with regard to educational multimedia in Europe and shows how the introduction of multimedia educational software can be made easier in schools, universities, vocational training and industry. The paper makes clear proposals for measures at European level, which should, however, be associated with national and regional measures. In this paper a very comprehensive case is made for the inclusion of multimedia systems in general and vocational education. The Task Force is adamant that multimedia technologies should have a permanent place in the training system. This is made clear by nine general proposals and 20 special proposals, which to a large extent refer to existing programmes.

When it comes to applying information and communications technologies to training, there is a great temptation to use such technologies to address deficiencies in further training, irrespective of the fact that changes have repercussions throughout the system especially when they are radical. This applies quite particularly to the increasingly predominant issue of basic and continuing training costs. Any attempt to reduce such costs also affects individual adaptability, entry into and transfers to new types of jobs, career and advancement opportunities, and access to vocational training. The learning system, training methods and competitiveness of the economy are also affected.

Although this assertion is largely undisputed, the interdependence of these aspects is scarcely taken into account. In the vocational training system as a whole and in individual firms, the possibilities of cutting costs through the introduction of multimedia technologies at present involve many problems.

The total costs to the community of continuing training have been recorded in Germany for about 20 years.[11] In addition to the difficulties involving surveys and methods for the collection of cost data, there are also other serious problems:

- Continuing training costs have always given rise to political disputes as a result of two conflicting tendencies: either the costs are seen as too high and there is a call to reduce pressure on the economy, or they are seen as too low and a loss of competitiveness in the German economy is feared and higher government spending is demanded.

- The changes in continuing training structures have been greater than in the cost recording methods. Continuing training has been increasingly decentralised and transferred to the workplace, which has led to cost recording problems not so far reflected in published results.

- Costs cannot be assessed without taking the benefits into account, and these are always missing in the data for any assessment.

Independently of these problems, the cost levels show the potential for the use of learning technology.

Costs of continuing training:[12]

European continuing training survey (1993)	DM 25 billion
Continuing training survey by the Institut der Deutschen Wirtschaft (1992)	DM 36.5 billion
Cost per participant	DM 2722
Cost per employee	DM 533
Costs as percentage of wages and salaries	1.5 per cent
Pay loss costs as percentage of total costs	48-60 per cent

In view of the level of costs, it is surprising that greater interest has not been shown in using multimedia systems as a means of reducing costs at national level. The explanation may be the widely divergent estimates of their actual potential.

The first requirement for the introduction of multimedia systems would be the existence of a technological infrastructure permitting their use. Owing to the pace of technical change, firms, schools and households cannot be expected to have computers and network connections with a full multimedia capacity. Reasonably-priced multimedia computers have only very recently appeared on the market. But even if multimedia operation is not possible with available equipment, the number of house and workplace PCs is evidence of a public willingness to invest in this technology. Where there is such a propensity, the short product cycles suggest that the situation will change in only a few years. From this viewpoint the position in Germany is good, even if the various data provided differ considerably.

Home PCs:

- 28 per cent of households have a PC[13]

- 17 per cent of households have a PC for private use (5 million), of which 75 per cent are MS-DOS or Windows PCs

- 9 per cent of households intend to buy a new PC in 1995

- the number of private PCs is expected to rise to 6.9 million in 1996[14]

Home PCs equipped with CD-ROM:

- 3.7 million CD-ROM drives in German-speaking countries (2.7 million in Germany), with 1.2 million for occupational use and 2.67 million for private use

- two-thirds of all PCs have CD-ROM drives[15] -- 1.7 million drives installed in Germany[16]

PCs in firms:

- No figures available. It can be assumed that the number of multimedia computers is very small

PCs in schools:

- No figures available. It can be assumed that the number of multimedia computers is very small

Learning programmes for general education in schools	about 3 500 titles[17]
Learning programmes for vocational education in schools and firms	about 3 000 titles[18]
CD-ROM titles in 1995	about 900 titles, growth 100 per cent[19]

Learning technology and corporate continuing training

For years multimedia learning had been presented at fairs and in the trade press as a cost-effective and efficient form of learning but although pilot projects for a training technology attracted great interest, the actual use of this technology in continuing training has remained limited. There was no basis for more extensive use, as the computers were not powerful enough, standards had not been harmonised, the programmes were unsatisfactory and experience with programmed learning in the 1970s had been inconclusive. Moreover, there was basically no incentive to reorganise course contents and the way in which they were taught. Firms were for the most part satisfied with the continuing training standards and systems.

This situation has changed only quite recently. Owing to its greater performance range and falling prices, today's standard computer has become a multimedia computer. With new storage systems, video sequences several hours in length could be included in programmes in 1996. Almost every new purchaser is therefore theoretically able to use learning programmes which are becoming increasingly attractive. New software platforms should also allow programme swaps between operating systems whose compatibility is at present very limited.

Developments in the telecommunications field are another important incentive. As a result of new data networks, the imminent liberalisation of the telecommunications market in Germany and the increasing inroads made by ISDN and Internet, telecommunications and multimedia are being associated for the first time in the minds of the general public. This has also created increasing interest in telematics-based learning.

This turning point coincides with a phase of very great economic change that had been marked by worldwide competition, dynamic product development, new marketing strategies and quality concepts, new organisation and production structures and above all by the business world's unprecedented cost consciousness. There has also been a shift in traditional training policy, and it was increasingly asked whether corporate training is the only field which might not have to be radically restructured. This was, however, only a rhetorical question, as all that had to be decided was how the increasing need for continuing training could be met by firms without a rise in the budget, or how the costs for the same amount of continuing training could be reduced without serious losses in training quality.

Available studies in Germany on multimedia learning do not yet provide any information on this new situation. There are many reports on the multimedia market in Germany, but they give only economic and technical information on the market. Secondary sources are mostly used, and ad hoc representative surveys and specific case studies are dispensed with. As there is nobody in Germany which collects or routinely collates data on multimedia learning, the statistical position seems unsatisfactory compared with the United States and the United Kingdom.

Empirical studies on the planning, development, use and evaluation of multimedia systems in company training are usually seen as "luxury items" in the research field. There are only a few studies based on primary and secondary sources and only a few findings on the effectiveness and costs of technology-based continuing training. Where specific case studies are available, they are already several years old and are partly out of date.

The Fraunhofer Institute has brought out a comprehensive study on the opportunities and risks for multimedia systems in corporate basic and continuing training. The authors consider that such systems provide a range of possibilities, even if basically they take a conservative view (see above):[20]

- decentralised training can lead to cost cuts;
- large target groups can be reached once programmes are set up;
- training times can be cut in some cases;
- the workload of training personnel can be reduced;
- knowledge can be passed on in a way that suits the individual;
- training staff whose workload has been reduced can concentrate on "difficult cases";
- in-house learning, learning at home and learning in continuing training centres will be possible;
- the students' various preferences and experience can be taken into account;
- redundancies will be avoided.

Kramer consulted 212 firms with more than 100 employees in 13 different sectors. His assessment of the multimedia market is cautious but basically optimistic, even if readiness to invest is limited.[21] Firms are ready to invest "only when the cost problem has been solved and the benefits have been demonstrated". No clear statements about costs and effectiveness are made in his study.

The most comprehensive specific case studies on the actual use of multimedia systems are the project reports on the pilot projects sponsored by the Federal Ministry of Training and Technology. Only some of the project reports are published, but they can be consulted.[22] Pilot project reports are issued every two years on major topics such as educational system design, evaluation, learning environments and simulation,[23] so that the experience acquired in a number of projects can be pooled and the findings further disseminated. Specialised periodicals also publish reports on various pilot projects. Such projects are carried out under special conditions which in practice do not usually exist. Aid is provided for 75 per cent of the project cost overruns. A requirement for funding is that the problems concerned and their solution can be transposed to other firms.

The only substantial published empirical studies have been carried out by Fricke for the Deutsche Bundespost[24] and VW and by Fackiner for Migros in Switzerland.

Fackiner stresses that the wide acceptance of multimedia systems, which is also reported in other studies, is his most important empirical research finding. Other important findings are the "unanimous approval of multimedia learning by company management and the possibility of improving programmes by means of evaluations". But she makes no claim as to the definite superiority of CBT. It is possible to learn with any media, but just how well depends on the actual medium and how it is used.[25] After an interval of several years Fricke came to the conclusion that, "instead of comparing multimedia learning programmes with traditional forms of instruction, a theoretical approach should be used to develop different variants of a new computer-based instruction programme and check them out experimentally".[26] Generalising by comparing traditional instruction with computer-based instruction in order to say whether one of the two is more efficient or less costly is not, in his view, a sound approach.

The state of research in Germany can be shown by the conclusions of a report on the effectiveness of multimedia and hypermedia learning systems. The authors conclude that "we do not yet know enough to make general statements about the possible effects on learning of multimedia systems". Even if multimedia systems have considerable potential for improving learning performance, "the vast majority of the multimedia systems now in service have little or no positive impact on learning performance".[27] Nonetheless, acceptance on the part of trainers and students, the hopes of positive impact on the learning process, and especially the expectations of a marked reduction in costs, are high.

The case study on Bosch is the pre-print of a part of an empirical study -- commissioned by the Federal Ministry of Education and Science -- on the possibilities of and limits to the use of multimedia systems by firms. In addition to Bosch, the study will probably report on the use of multimedia systems by BMW, Deutsche Postconsult, motorway service stations, a large bank, a warehouse group and Mercedes Benz.[28]

Case study -- Robert Bosch GmbH

The Bosch Group

Robert Bosch GmbH is an electronics firm. In terms of turnover, it is among the top ten industrial enterprises in Germany. The firm has about 95 000 employees in some 50 locations in Germany, while worldwide it has about 150 000 in some 170 locations and around 140 production plants.

The international corporate structure started to be built up at the turn of the century. Since then many subsidiary and associated firms as well as foreign agencies in more than 130 countries have joined the company's ranks. International operation is still an important aspect of corporate policy; about 50 per cent of turnover is earned outside Germany. The United States is the leading foreign market. Today the product range comprises not only vehicle equipment, but also public and private communications systems, radio systems, traffic control systems, thermo-electrical equipment, packing machines, industrial equipment, hydraulic systems and pneumatic systems.

The Bosch group is highly decentralised. Communication structures are multi-layered both within and between locations. Bosch is setting up its own corporate telecommunications system.

Some nodes for this Bosch Corporate Network (BCN) already exist; in Germany they are Frankfurt, Düsseldorf, Stuttgart and Reutlingen. In the final phase all the Bosch group's sites are to be connected with the BCN which will be a low-cost telecommunications system providing additional services.

Multimedia technology is not used by Bosch only for corporate continuing training. On some sites, the video conference rooms already available are used for long-distance communications. Conventional CBT learning programmes are mostly used at present.[29]

The firm's approach to continuing training

Continuing training is of great importance within the Bosch group. Since the innovation cycles of the group's customers are increasingly shorter, Bosch is constantly confronted with new activities and challenges. The group lives off its staff's innovative capacity and creativity. "Maintaining innovative capacity, which is primarily based on a large pool of permanent, experienced staff, is a basic aspect of corporate policy."[30] It is therefore necessary to train staff at the right time, regularly and in response to needs. In addition, the personnel themselves express great interest in continuing training.

Initial in-house training, which leads to a certificate and a trade under the dual vocational training system, is strictly separated from continuing in-house training, which is intended to maintain skills, improve skills and meet the demand for new skills. Whereas in the past continuing training was given at intervals, continuing training in the future will have to run parallel to occupational activity.

The Bosch group's declared aim is to provide continuing training adapted as closely as possible to needs and at least cost. Continuing in-house training in the form of conventional seminars has become too expensive. For this reason the use of computer based training (CBT), and increasingly multimedia CBT, is being stepped up. Other forms of multimedia learning technology are planned for the near future.

Basic knowledge is to be mostly provided in the future by means of CBT which would be completed by seminars and workshops. Seminars will then be able to build on a similar level of knowledge among participants and will be run more efficiently and it will be easier to assess the results of continuing training. Seminar participants will be able to focus as a team on practical problems. CBT systems are also to be used in seminars to benefit fast learners who can thus learn more. Behavioural CBT is seen as useful only in connection with conventional seminars.

The use of CBT is based on strategic factors:

- Many households are already equipped with PCs which are often more recent than those used in the workplace. Why should the personnel therefore not use their own PCs for their firms' continuing training programmes? After all the same personnel use their own cars for work-related purposes.

- Aid is provided for learning outside working time. This is possible with CBT. Bosch meets the costs of purchasing a PC, which the employee uses at home for continuing training, and the costs of the CBT programmes, which the employee works through at home. If an employee is trained at home, Bosch has no labour costs to pay.

The continuing training programme which is to meet worldwide demand within the Bosch group distinguishes between:

- internal continuing training during working time, the "yellow programme", and
- continuing training during the employee's free time, the "blue programme".

The 1996 continuing training programme comprises about 600 different seminars on 1 500 dates and with 14 organisers as well as about 100 computer-based training programmes. In 1994, 16 215 employees took part in 1 221 seminars during their free time, while 40 351 employees attended 3 824 events during working hours. The trend showed an increase of over 20 per cent in free time events and a decrease of the same order in events held during working hours.

CBT has already replaced seminars for basic instruction and is used as a complement to conventional seminars for more advanced training.

In 1994 Bosch's costs for basic and continuing training in Germany amounted to DM 265 million. The annual cost of continuing training per employee was DM 1 024. The Bosch group's continuing training system received ISO 9000 certification at the end of 1995. The requirement to determine the employee's training needs and meet them is stated in the group's quality manual.

Organisation of corporate continuing training

Like all other corporate activities, continuing training is also decentralised within the Bosch group. The Head Office for corporate continuing training is in Stuttgart, and there are local divisions at a few other sites. Seventy-three employees work in the continuing training divisions worldwide, and 22 of them are at Head Office in Stuttgart. Orders for CBT are handled on a worldwide basis at Head Office by a single trainer.

The Stuttgart Head Office is broken down into departments, such as the one specialising in continuing training for sales and after-sales. The information provided in this paper refers to corporate continuing training for the engineering and data processing fields. The individual departments responsible for continuing training co-operate closely and regularly exchange information.

Bosch plays an active part in the Working Party for Training in the Car Manufacturing Industry (AKAD). AKAD's standards catalogue for the assessment of corporate continuing training is the basis for the choice of CBT programmes by Bosch.

Continuing training management

Continuing training in the Bosch Group is organised on a voluntary basis. Employee motivation is seen as a key factor in the quality of continuing training.

The continuing training departments see themselves as bodies providing continuing training services for the firm. The training to be provided is based on an analysis of training needs. The arrangements for determining training needs are as follows:

- The provision of corporate continuing training forms part of the group's human resources development plans. The need for training and other requirements are defined in annual appraisal interviews.

- Along with the employees, the heads of specialised departments decide on the content of continuing training and pass on their requests to the continuing training departments.

- Employee demand for CBT is assessed statistically. When a CBT programme is ordered, the employees therefore have an indirect say in the decision as to whether a programme remains on offer or is withdrawn from the list of available programmes. The continuing training departments do not have the final say on the provision of continuing training. The decision to provide training during working time is taken by the heads of specialised departments, possibly in conjunction with the employees. It is up to the employees to decide whether or not they want continuing training outside working hours.

Choice of CBT programmes

The choice between the purchase of standard CB programmes, those made to order for Bosch or those developed by Bosch itself mainly depends on the quality of supply. The evaluation of standard CBT programmes involves a considerable workload. The assessment is based on a thorough test with the use of the AKAD standards catalogue. Specialists are consulted to review the programme content and the teaching approach.

If very good standard CBT programmes are available on the market, they will be used for continuing training. Standard CBT programmes cost less than those developed by Bosch itself or made to order for the group. In many cases, however, standard CBT programmes cannot provide all the knowledge required. For example, the standard CBT programme for Word 6.0 contains about 80 per cent of the knowledge required at the workstation. Bosch's own masks in Word 6.0 are not taught by CBT programme. In such a case the user could modify the standard CBT programme, but Bosch does not do so. Its employees are expected to learn how to use Bosch's own masks without relying on the CBT programme, for any modifications to a standard programme would result in additional costs. In addition, the need for repeated modifications to standard CBT programmes could always arise in the event of changes to Bosch's own parts of the programme, for example to masks. In the Bosch Group, standard CBT software systems are made available and bought within the "Bosch CBT partnership". In addition, learning software systems, including multimedia systems, are produced by Bosch itself or made to order for the group.

It is to be noted that for the time being standard CBT programmes are selected by the continuing training department but specialised departments and potential users also have a say in the selection, since the final decision to buy a programme is taken by managers or employees when the time comes for continuing training.

The Bosch CBT partnership scheme

Learning centres could not work properly since the Bosch Group is highly decentralised. According to Bosch's continuing training department, learning centres are a thing of the past. They were the answer when computers and programmes were costly. Labour is now a more important cost item since hardware and software costs are falling and training needs are continually increasing.

The "Bosch CBT partnership scheme" was developed in 1994. The partnership includes three groups:

- Bosch employees who apply for continuing training, use continuing training facilities and, through the demand for such facilities, influence its supply.
- CBT partners, which are CBT suppliers. At present there are three of them.
- Bosch itself, which is responsible for co-ordination and quality assurance.

There are four stages in the introduction of the scheme which is to be completed in 1996. In stage 0 the CBT supplier market was analysed at home and abroad. Firms willing to participate in the partnership were selected. Bosch is very demanding with regard to potential CBT partners. The group does not buy any company licences, but simply negotiates the purchase price of CBT programmes. CBT partners share commercial responsibility for the scheme.

In the first stage about 80 subjects were selected from three CBT suppliers and provided throughout the group. The main subjects were databases and PC basics. A standard PC with conventional CBT programmes was used. The scheme is now in its second stage. Existing computers are being upgraded or multimedia PC packages, known at "continuing training PCs" in the Bosch Group, are being used. In addition, language programmes and other learning programmes are provided for applications software, as are multimedia learning programmes on CD-ROM. In the third stage of the partnership, all subject areas will be covered by CBT, including behavioural training. Multimedia PCs with multimedia learning programmes will be used. The third stage will start in mid-1996. In the early development phase of the CBT partnership, the focus was on German-speaking employees. The regional companies, *i.e.* Bosch's firms abroad, have been included in the scheme since the start of this year.

Within the partnership a CBT programme should not cost more than a good reference book. At present most CBT programmes cost DM 100, while foreign language learning programmes cost DM 150 owing to the greater time span. CBT programmes designed exclusively for learning in the employee's free time cost only DM 38. The procedure for corporate continuing training including the order for a PC and/or CBT software is as follows. The Bosch employee or his supervisor fills in a fax order form. There are three possibilities for the settlement of costs when an order is placed:

- Learning in the workplace, during the employee's free time and during breaks. The employee/supervisor places the order with the cost centre and the delivery address is the department.
- Learning at home: the employee/supervisor places the order with the cost centre and the delivery address is the employee's private address.

- Learning at home: the employee places a private order. In this case the employee receives a voucher and a certificate to the effect that the computer/CBT software has been acquired for continuing training.

An employee can also apply for continuing training which he does not need for his job. But in this case he must purchase and use CBT programmes privately.

Costs

CBT costs are comparatively low for Bosch as well as its employees. The decisive factor here is that the firm does not start to incur costs until its continuing training is to take place, *i.e.* until a specialised department orders a CBT programme. If an employee decides to purchase a CBT programme privately, Bosch incurs only a limited administrative cost.

In comparison with this system, a learning centre would result in fixed costs from the time at which the centre was set up, and monthly fixed costs would be incurred independently of demand for continuing training.

Levels at which continuing training is provided

In continuing training for engineering and data processing, a distinction is made basically between only two levels in the hierarchy: management staff and all other employees. Continuing training is not the same for management staff as for other employees. Prior to the introduction of CBT, management staff such as departmental heads, scarcely took part in continuing training, despite the need for training at this level. It seemed embarrassing to a head of department to go on a continuing training course in which his secretary, who was obviously more at home with a PC, might also be taking part. But ever since CBT was made available for management staff, demand at this level has also been high.

The vast majority of those who take part in continuing training are white collar workers (80 per cent). With the use of CBT, the proportion of managerial staff in continuing training has risen to about 20 per cent, and the proportion of wage-earners to 10 per cent. Foreign employees, for example, are very interested in German language courses.

Promotion of continuing training

Bosch uses many possibilities to promote corporate continuing training:

- Articles by the continuing training department are published in "Bosch-Zünder", the house magazine (issued about 12 times a year).

- The "Yellow Brochure" with the continuing training programme appears once a year.

- Another brochure which gives the continuing training programme and has a circulation of about 10 000 readers worldwide is published twice a year, especially for managerial staff.

- The "yellow diskette" is an electronic version of the continuing training programme. It is available free of charge to all employees. The present diskette covers the continuing training programme for 1996: about 600 different seminars, 100 CBT programmes and 1 500 dates for seminars run by 14 organisers. The contents of the "yellow diskette" are already stored on local network servers within the Bosch Group. The employees can therefore also obtain online information via their workstation PC. Information on the continuing training available is updated daily on the network.

The "yellow diskette" gives a hierarchical overview of the continuing training programme, including a list of the seminars and CBT programmes. The subject, objectives, participants and requirements are described for each continuing training course. Dates, prices, locations, organisers, background material, contacts, travel details and sketch maps can be requested for seminars. The number of hours, prices and technical requirements are given for CBT programmes. Extensive search functions, requirements for the use of and orders for CBT programmes, external training partners, contract conditions and other information are also included on the yellow diskette. An employee can call for and complete a reservation or order form via the diskette or the network.

Formal and informal types of continuing training

Informal types of continuing training are available at Bosch. The continuing training department considers that more can be achieved with a sound CBT system than with informal types of continuing training such as online help, assistance systems and tutorials.

Other informal types of continuing training are provided in the form of workshops, symposia, etc., but multimedia systems are still not used in this connection.

Monitoring of continuing training

Continuing training is monitored at a number of levels. User statistics are collected and regularly updated for CBT activity. Employees complete the CBT appraisal form and provide personal data on a voluntary basis. The computer-based statistical assessment distinguishes between the employees' sex and grade (wage earner, white collar employee, supervisors).

The CBT programme suppliers operate a permanent hotline, and note and eliminate the mistakes found by the users. At the same time this information is used to evaluate the CBT programme.

Suggestions by employees for the improvement of seminars and CBT are evaluated by computer.

The costs of continuing training are recorded but a cost/benefit analysis and a comparison of the relationship for different learning systems is, however, simply not possible. One reason for this is, for example, that many supervisory or executive staff now use CBT systems, although in the past they had often not taken part in seminars. No comparison can be made in such a case.

Training results are checked by means of questionnaires (CBT assessment forms) and by talks between employees and supervisors. Recording of training results is voluntary. Steps in the transfer of knowledge are neither defined nor checked. Studies on training results and the transfer of knowledge are planned for the future in connection with courses leading to a certificate.

Critical factors in success

The critical factors in the success of the Bosch Group's efforts are the cost reduction and improved training results obtained by motivating employees to take further training and by offering them better learning methods and media.

Continuing training is not certificated. Employees themselves decide whether details of their continuing training are kept in their personal records or not.

Use of multimedia systems for continuing training within the Bosch Group

Description

Multimedia learning technology is used at Bosch in connection with CBT. The objective of using multimedia CBT is "to transfer knowledge and information that is compact, complete and clear". In computer based training, no fewer and no worse media should be used than in conventional seminars. Multimedia CBT is to replace some conventional seminars.

So far certain CBT programmes have been chosen even if the form was not up to the desired standard provided that the course content and the educational approach were considered excellent.

At present multimedia CBT is mainly used for learning foreign language study since in this case interactive learning gives better results. The first CD-ROM courses on PC software and data processing basics are available for continuing training. In addition, two multimedia CBT systems are available exclusively for free-time training: Bosch's Electrical Tools Encyclopaedia and Do It Yourself, the first CD-ROM for handymen.

Hardware/Software

In the Bosch continuing training programme, multimedia PCs, known as continuing training PCs, have included the following since the start of this year:

- an Intel Pentium Processor, 90 or 100 MHz;
- a 256 KB second-level cache;
- a graphic controller on the PCI bus;
- an 8 or 16 MB work store;
- an 850 MB hard disc;
- a 3.5 inch diskette drive;
- a CD-ROM drive (4 x spin);
- audio on board;
- a mouse and a keyboard;

- a 15 inch/35 cm colour monitor (17 inch/40 cm colour monitor optional);
- Windows 95;
- on request, MS Word 6.0, MS Excel 5.0, MS Access 2.0;.
- a three-year guarantee (within Bosch) in Germany.

Costs

At present multimedia learning software accounts for about 10-17 per cent of total continuing training costs.

Results and problems

At the start of the CBT partnership, the CBT programmes available were mainly used to test existing knowledge. The employees were not receptive to this type of CBT and demand for it declined. In the meantime such programmes have been withdrawn from the continuing training programme.

In one case a CBT programme that had not been properly checked out was provided for continuing training owing to the pressure of time. The employees criticised its quality and were given the option to return the programme, which most of them did. This CBT programme was immediately withdrawn. It is assumed that employees spend more time learning with a CBT programme in their free time than they would during or after work at their workstation, although it is impossible to say if this is so. Nor is it possible to check either whether employees work through the entire CBT programme in their free time. In the future the plan is to monitor training results in connection with work leading to a diploma.

A cost/benefit study of the use of multimedia learning technology is not feasible.

Prospects

The Bosch Corporate Network is expected to result in greater use of multimedia systems in all fields. In this connection the extent of change will depend basically on the services and future pricing policy of public telecommunications operators.

Full networking within the Bosch Group (scheduled for 1997) is the precondition for the implementation in the near future of the projects described below.

The possibility is being considered of distributing via the World Wide Web the information on the continuing training programme currently stored on the "yellow diskette". The employees would then have the choice of calling the information via their home or workstation PC and be able to order CBT programmes electronically. CBT programmes could then be loaded into the home PC via the network. Another possibility would be to use CBT software which is available via a server on the Bosch Corporate Network. Disk capacity would be saved and CD-ROMs would become superfluous. The problems expected in connection with these possibilities concern security and accounting procedures.

The creation of "virtual classrooms" and other forms of virtual group learning for employees is planned for the future. Employees are to be given the possibility of sharing with each other what they have learnt by means of a CBT programme, for example by practising a foreign language within electronic communication groups, in which they communicate in the foreign language studied. This type of informal continuing training is to be possible both during and outside working time. A basic precondition for home-based communications is improved telecommunications and lower costs.

A scheme suitable for similar firms

The dissemination of continuing training programmes via the "yellow diskette", an electronic medium, is already of interest to other firms. The "yellow diskette" concept and software have been bought by VW and is soon to be introduced by this firm. Talks with other firms are already under way.

The introduction of multimedia in firms

In retrospect it is amazing that multimedia learning has survived the long and difficult years of inadequate hardware, unsatisfactory software, uncertain learning results, unproven cost advantages, high development costs and the absence of ideas on application. Today however all big firms are experimenting with multimedia learning systems, and have to a very large extent already made them a permanent part of their continuing training. Möhrle's prognosis that by the year 2000 the proportion of firms' continuing training supported multimedia would exceed the 20 per cent threshold no longer seems utopian.[31]

Multimedia is seen primarily as a way of reducing training costs and improving individual learning. This is certainly true in the case of Bosch. The firm has consistently endeavoured to reduce costs and has taken the most radical step in this direction by shifting learning to the leisure time of its staff. Lean Management has now also reached continued training. Savings in wage costs, trainers, upkeep of an individual PC, travel and hotel expenses for seminars are clearly so considerable that the firm can afford to help finance hardware and software for staff while still reducing costs.

It is interesting to note that although emphasis is constantly on the cost aspect, in Germany at least no reproducible calculations are available. Since the results achieved with different learning methods are difficult to assess, firms' internal calculations are probably based on the assumption that similar results will be achieved within a given period if multimedia support is provided, so that cost remains the only relevant factor. On the assumption of comparable learning results within a given period it is obvious that multimedia learning programmes, particularly those pursued by staff in their leisure time, will reduce trainer, travel, hotel and wage replacement costs as compared to traditional training methods.

Introduction at Bosch was extremely pragmatic and in four phases, progressively bringing more and more areas of continuing training into the new learning system, backed by new hardware and software. With constant training budgets the growing demand for continuing training can no longer be covered via existing arrangements. Multimedia is seen as a new way of resolving problems that have now become acute, the vital impetus being given by cost reduction. However, the course now adopted involves more than just cost reduction and the shifting of continuing training to the leisure time of staff.

Multimedia can be approached from a number of standpoints:

	Phases	Approaches	Questions
Phase 1	Multimedia as technical process	What technical conditions are required to apply information and communications technologies to learning?	Hardware standards, software standards, telecommunications
Phase 2	Multimedia as educational and methodological process	What teaching and methodological concepts are needed to exploit technical possibilities in an optimum way?	Behaviourist, cognitive, constructivist learning theories, interface, ergonomics, quality criteria evaluation
Phase 3	Multimedia as teaching/learning process	What skills does the trainee/teacher need to organise the teaching/learning process in an optimum	Training of the trainer, preparation for computer learning
Phase 4	Multimedia learning arrangements	How can multimedia be integrated into the traditional learning environment, what new learning environments are meaningful	Application, learning environments, learning at the workplace, distance learning, learning centres, instruction, tutoring, virtual learning groups
Phase 5	Multimedia as organisational process	How can educational technology be applied for the further development of the firm	Educational technology: -- as reaction to shortages of skills -- to reduce costs -- to adjust to technical change -- to form a new teaching/learning/organisational culture -- to develop and form new working and organisational processes

Firms which use multimedia in their continuing training activities are generally confronted with problems in the technical, methodological/educational, teaching/learning and learning arrangement fields at one and the same time. The fifth phase is however encountered only in particularly innovative enterprises.

The problem areas are not isolated one from the other, but affect and merge with each other. Decisions regarding specific learning arrangements thus imply use of a specific technology, the educational design chosen requires a changed learning culture, etc. The phases as set out above also suggest successive decision-making in the different areas, which is in fact not possible.

On Phase 1

Before the technical problems of multimedia on a PC have been fully resolved, users are already being confronted with telecommunications issues. Before the first challenge has been dealt with users are already faced with the next one. Failure to keep up with technical developments over a six-month period can mean practically missing a technical generation. Generally however the importance of the technology of multimedia is declining as performance and user friendliness increase.

On Phase 2

At the same time it is increasingly clear that technology is not the only problem. Without appropriate training content and adequate multimedia teaching theory technical possibilities cannot possibly be of use for learning purposes. It is still unclear for what content and target groups behaviourist, cognitive or constructivist design principles can be used, how they can be applied and what types of programmes will emerge to resolve specific continuing training problems. It is possible that the true dimensions of multimedia learning have not yet been recognised, since we are still too firmly enmeshed in written culture and learning sequences. It is perhaps difficult to imagine the form of media using texts, graphics, images, sound and video in line with new learning theories to devise new types of programme or how the learning process would then take place. What sort of assessment would be necessary to make optimum use of such programmes and processes?

On Phase 3

Even when the technical and teaching method problems are resolved it is still not clear how multimedia can actually be applied in practice. The fears of trainers and the need for them to develop a new understanding of their role were in the past a real obstacle to introduction of multimedia. Demands on students are equally great. They do not find it easy to pilot the learning process themselves and loose themselves in the maze of multimedia learning or feel themselves narrowly confined within it. Alternatively, they may be fascinated by the potential of multimedia without significant educational gains.

On Phase 4

An empirical investigation on behalf of the Federal Institute for Vocational Training led to the conclusion that a bad programme which was well applied could be more successful than a good programme inadequately applied. Successful learning is determined not only by the learning programme but also, and to the same extent, by the form of the multimedia application.

Only too often multimedia learning programmes are introduced in an otherwise unchanged learning environment. In fact, multimedia decisively changes the learning set-up, if only in that trainers no longer have to impart factual knowledge since examples can be studied on the PC in groups. Multimedia has still more marked consequences when traditional places of learning lose their significance and new ones emerge.

Bosch has displaced some continuing training into employees' leisure time. For what content is this particularly appropriate, and in which cases is it scarcely possible? What target groups can benefit from these possibilities, which ones are excluded from it or encounter special difficulties? What sort of learning set-up could combine phases of personal learning with multimedia-based learning? What is the role of tele-tutoring? How can learning opportunities at the workplace be used to best advantage? The latter are crucial not only because learning at the workplace is the commonest form of in-firm continuing training but also because it combines practical experience, action and learning. Few soundings have been taken of the potential of multimedia support for these learning processes.

On Phase 5

Lastly, decisions under 1-4 above involve giving effect to measures based on an overall set of corporate objectives. It has been noted that in many instances multimedia is seen as a kind of "repair shop" for gaps in employees' skills, enabling shortcomings to be made good at no extra cost or at less expense than with traditional continuing training methods. Decisions taken may however have implications affecting the entire continuing training system. The "Bosch" example demonstrates that in addition to cost cutting a process is set in motion that can transform the entire continuing training system.

If we move away from the idea of multimedia as a means of minimising training costs and communicating individual skills towards that of the targeted reorganisation of continuing training, new prospects are opened up whereby multimedia learning may contribute to reorganisation processes within the firm. Introduction of multimedia then depends on organisational objectives and at the same time opens the way to the achievement of goals which would be unattainable without it.

Commercial objectives, *e.g.* better customer service or the introduction of quality management, in many cases only become viable using information and communications technologies. But providing staff with the required qualifications may also depend on multimedia and telecommunications. Multimedia learning programmes can be used to make available to staff the data and skills needed for better customer relations and quality management at all levels within the firm. Whenever the work process is built on new information and communications techniques the prospects for multimedia learning systems are particularly good. Telecommunications in particular open new perspectives for multimedia learning and organisational changes, at first mostly in the form of pilot projects.[32]

In Germany Mercedes-Benz AG and SEL are undertaking a particularly innovative project. The so-called Automobile Customer-Oriented Broadband Information System (AKUBIS) aims to ensure intensive communication between manufacturer, regions, branches and other partners. The pilot project gives customer service instruction via video conferences, interactive distance learning and use of real time multimedia communication to enhance the firm's customer relations.

The move towards the information society outlined in the introduction has also changed the organisation of production and management. The watchwords are: less hierarchy, decentralisation, integral work structures, and participative forms of organisation. "The emerging highly developed work organisation is linked to basic changes in skills. (...) Work is being reskilled through the reacquired breadth of areas of activity, and also through options resulting from open forms of action, integral work responsibilities and the fine tuning of work organisation. Common to these new functions are the reintegration of previously separate jobs and a high degree of self-management and individual responsibility on the part of skilled workers. Skilled work requiring qualifications together with teamwork and self-learning are on the increase."[13]

The challenges of worldwide competition and of the information society can be met by new forms of organisation. The latter in turn require new skills. The potential of multimedia learning can be realised by combining it with processes of organisational change.

The influence of information and communications technologies on work processes is continually growing. Management and production increasingly use data prepared on the latest PCs using multimedia. It is only logical to enrich this data through learning content. The facilities provided by current application software and workplace-related electronic assistance are steps in this direction. Whenever PCs are used for work purposes learning sequences can also be made available. Even where the computer is not the main working tool the learning potential of the workplace can still be exploited through systematic programmes related to the structure of the discipline as well as through experience-based aids for the work process.

This trend towards workplace-oriented learning goes hand-in-hand with organisational developments in the direction of decentralised and less hierarchical structures, integral work processes and participative forms of organisation. The innovatory potential of multimedia is thus fed from numerous sources: technical possibilities, educational and methodological advantages, opportunities for new teaching/learning processes with new roles for students and teachers, the emergence of multimedia workplaces combining work, information and learning, and the need for new organisational and work structures.

Regardless of place, time and learning level, multimedia gives all members of an organisation the possibility of self-directed learning. Multimedia can:

- bring work and learning together;
- allow experimentation in relaxed and relevant situations;
- link systematic and experience-based learning;
- exploit the learning potential of the workplace;
- reflect a multiplicity of experience;
- simplify complex specialised knowledge;
- help visualise problems;
- bring together learning groups;
- encourage organisational development and promote improvement processes;
- simulate work processes.

The fact that multimedia can also cut continuing training costs is at present seen as its main advantage and will speed up its introduction for continuing training in the firm. This is however only one of the many opportunities it offers.

While learning at the workplace will become increasingly important, multimedia and telecommunications also offer opportunities for learning at home. The home was previously given little attention as a place of learning. But now, Bosch has displaced continuing training in basic courses from work to the home and has discontinued training at the workplace. Telecommunications will help this development. Whereas a few years back emphasis in firms' continuing training was on central training units, new places of learning offering new learning opportunities are now replacing them. Individual learning is more closely linked to individual advantage.

To make this process of introducing multimedia accessible to traditional planning instruments we set out below a theoretical planning model for the reorganisation of firms in response to changes in their environment.[34]

The learning organisation

Firms do not only react to external changes in their environment but must also prepare themselves for changes which are not yet foreseeable. The best example is multimedia itself, whose potential is clear in outline but is nevertheless constantly shifting and opening the way for developments which not so long before would have been seen as impossible. Not only individual members of the organisation and groups, but also the organisation as a whole must be capable of learning, *i.e.* must become a "learning organisation".[35]

According to Garvin (1993) a learning organisation is "an organisation skilled at creating, acquiring and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights (...). Learning organisations are skilled in five main activities:

- systematic problem solving;
- experimentation with new approaches;
- learning from their own experience and past history;
- learning from the experiences and best practices of others;
- transferring knowledge quickly and efficiently throughout the organisation.

By creating systems and processes that support these activities and integrate them into the fabric of daily operations, companies can manage their learning more effectively".[36]

The introduction of multimedia could draw on this concept of the learning organisation. Systematic problem solving, experimenting with new approaches, preservation of experience and expertise, and the availability of knowledge are the strong points of multimedia learning. To recognise and exploit this potential means doing more than focusing on cost advantages and going beyond the prevailing view of adapting skills to the external environment.

Political implications

The European Union reacted to the increasing importance of information technologies at an early stage and promotion programmes such as DELTA and COMETT did much to heighten awareness and help solve problems at European level. However these programmes were primarily technological. Only the last Call for Proposals under the Telematic Applications Program was user-oriented. This application-oriented trend is continuing in the papers of the recently established Task Force on Multimedia Educational Software. To evaluate the significance of these initiatives it should be pointed out that the last Call for Ideas brought in some 7 000 proposals and that several billion DM are available for promotion programmes throughout the EU.

In the 15 German *Länder* the situation is variable. North Rhine-Westphalia,[37] Baden-Württemberg and Bavaria are in the lead, with innovation-friendly policies from the outset (Baden-Württemberg) or with the accent on promotion of industries of the future, in order to deal radically with the consequences of economic change (mining, heavy industry in North Rhine-Westphalia). Other *Länder*, such as Berlin, Brandenburg and Saxony are preparing similar structural programmes.

The Federal Government has constantly provided funds for innovative vocational training projects via various ministries. The Federal Ministry for Training, Science and Technology has thus since 1971 promoted over 600 model projects, divided almost equally between the school and non-school sectors. A variety of over 1 000 firms and a similar number of schools are involved in these projects. From 1971 to 1994 DM 580 million were made available for them. If funds from the *Länder* and industry are included a total of over DM 1 billion has gone to model projects to improve vocational training.[38]

In view of the importance of information and communications technologies for vocational training the situation is however not satisfactory. In retrospect it can be said that at least up to the beginning of 1995 technology-based and further and continued training was not given the attention it deserved. Nevertheless some ten pilot projects to promote multimedia learning were 75 per cent funded by the Federal Ministry for Training, Science and Technology and scientifically supported by the Federal Institute for Vocational Training. Numerous other individual projects were certainly also promoted although no overall data are available. It is to be expected that the European Union, the Federal Government and the *Länder* will provide overall support and co-ordination for multimedia learning.

A series of initiatives are currently being discussed, relating primarily to the schools. Although Bertelsmann, probably the biggest supplier, has indicated that the school market is not for the time being of any interest to the firm because decision-making for procurement is so lacking in transparency and inflexible, the actual trend is nevertheless clearly in the other direction. The *Land* of North Rhine-Westphalia thus plans to network 500 continuing training establishments and provide at least one multimedia computer for every establishment. All such schools will be included by 1999. Deutsche Telekom will in the next three years make available some DM 30 million and install an ISDN connection free of charge in all schools. The Deutsche Gesellschaft für Informatik has developed a proposal "Schools on the Net" entailing the design, organisation and application of a multimedia training initiative. The publishers Cornelsen and Klett are setting up a training server (German Training Net) which will by the end of 1996 offer facilities still to be precisely defined.

Whereas in the schools the division of responsibilities between the Federal Government and the *Länder* (the *Länder* are responsible for in-school training) and support by industry are critical, the situation with in-firm continuing training is somewhat different. Large firms are mostly introducing multimedia on a pragmatic basis, and have in some cases called in external consultants. With few exceptions the programmes are being developed separately for each firm, mainly by outside specialists. Depending on commercial objectives, support by the State or by hardware suppliers and network operators is or is not available. The forthcoming liberalisation of the telecommunications market is a particularly important State initiative, expected to lead to a sharp reduction in charges.

Small- and medium-sized enterprises on the other hand lack the staff and financial resources needed to introduce multimedia. It would only be worthwhile where advantages are obvious and easy to achieve. State action is required here since there is a danger that multimedia will strengthen the competitive advantages of large and innovative firms.

In all areas of application of multimedia learning the shortcomings in terms of educational methods, the teaching and learning process, the learning set-up and in-firm organisational development which were outlined above continue to be of relevance. Closer co-operation between science and practice is required here. The pedagogical aspects of the economy in universities focused in the past on teaching in schools. Problems of in-firm continuing training were seen as of little importance. Even less attention was given to technology-based learning. Recently the situation has changed in various universities, and authors outside the universities have also looked increasingly at multimedia learning.

Germany is thus at a turning point where industry, the State and the scientific community are creating the conditions for the transition to the information age. The importance of this transition led to the setting up of a "Multimedia Round Table" as a discussion forum to steer this process.

Conclusions

The introduction of communications and information technologies amounts to a second industrial revolution. As with all revolutions the outcome is uncertain and the validity of forecasts over time is short. What is certain is that the challenges of the future cannot be met with the structures of the past and that the problems of the coming third millennium cannot be resolved with the processes of today. This is true of society, the economy, and individual firms and citizens, even though the true scale of the challenge is, like an iceberg, not readily apparent to everyone.

Global technological and scientific change has acquired a dynamic that seems impossible to control and offers the alternative only of adjustment or failure. Failure faces those unable to keep up with unpredictable adjustment processes.

The introduction of information and communications technologies alters structures and processes within firms and cannot be restricted to a clearly defined area. Introduction of multimedia in firms is thus not merely a matter of adding one more medium but involves a new learning system which affects the entire further and continuing training set-up. Only systematic strategies for change can cope with this situation.

Firms must increasingly not only deal with changes to their environment that are difficult to evaluate, but must also develop structures and processes allowing for flexible adjustment and adaptation to what are largely uncertain developments. This requires learning by the individual, learning by the group and learning by the organisation. Multimedia must back up the potential of these learning processes and give firms room to manoeuvre on the road to becoming learning organisations.

The introduction of multimedia in firms is part of an organisational development process and can be planned using commercial economic instruments.

Firms using computers as a working tool and guided by information and communications technology are best placed to apply those technologies to support further and continuing training.

Small- and medium-sized firms whose continuing training problems are difficult to resolve owing to lack of resources, high costs, lack of time and pressure of competition, can turn to standard multimedia learning systems. Staff can learn on a decentralised basis in the workplace or at home.

Telecommunications can link places of learning, bring together learning groups, provide tutorial support, learning programmes and other information. New virtual places of learning will emerge, traditional ones will provide new services and new types of links will become important.

Multimedia not only provides the conditions for assessing the special advantages and disadvantages, as well as the results of multimedia learning, but also gives new meaning to individual learning.

Multimedia offers entirely new opportunities for the methodical and efficient transmission of learning, which vocational continuing training can enrich and make still more effective.

Traditional written culture and the sequential presentation of information is now changing. The information age will develop a teaching/learning culture based on multimedia. The opportunities and dangers must be recognised in good time and the necessary adjustments made. Traditional training content and values should not be abandoned at too early a stage.

A technology-based learning culture should not be allowed to exclude sections of the population from access to further and continuing training, promotion opportunities, transfer from one field to another, adjustment to new developments, lifelong learning, income security or social status.

Proposals

1. Plans to introduce multimedia learning systems should be co-ordinated between the EU, Federal Government and the *Länder*.

2. Infrastructure for multimedia learning in schools and universities should be improved by concerted action by industry and the State.

3. Exchange of international experience should be stepped up. Worldwide information and communications technologies lead to similar experience in practice.

4. Application-oriented pilot projects for vocational continuing training and corporate training networks should be promoted.

5. Regional information, advice and co-ordination centres for private users and small- and medium-sized enterprises should be set up.

6. Small innovative centres for the development of learning programmes should be promoted.

7. Universities should be increasingly involved in application-oriented research (in connection with pilot projects). Experimental projects and research into the consequences of multimedia learning systems continue to be important. Basic projects involving international researchers should also be supported.

8. Networks for the exchange of experience in planning, development, application and assessment of learning programmes should be strengthened.

9. Quality control and an information system for multimedia learning programmes should be set up.

10. The roles of the State, science and the economy should be unified and guided.

11. Centres of excellence for multimedia in firms, schools and universities should be identified, rewarded and promoted.

12. All opportunities to promote learning organisations with multimedia should be exploited.

APPENDIX -- SOME EXPERIMENTS

Non-school model experiments with multimedia learning

Ongoing and completed experiments

Experiment	Institution	Period
Qualification of staff in retail in computer-supported goods management	Inner Media, Wiesbaden	1.10.87 - trade 30.9.91
Development and testing of self-guided continuing training -- training of office staff in PC-supported commercial duties (SWING)	Research Institute for Vocational Training in Trade at Cologne University	1.10.91 - 30.6.94
Multimedia, workplace-related continuing training in the introduction and use of information and communications technologies in trade (IKTH)	Experimental team Munich adult evening classes	1.10.92 - 30.6.94
Development association "Work-based CBT for the introduction of technical facilities"	IFA Institute for Vocational Continuing and Further Training GmbH, Bonn	1.11.91 - 31.10.94
Design, development, trial and promotion of teaching and teaching materials for the function "PC specialist adviser" in trade	Control Data Institute GmbH Munich	1.11.89 - 31.12.92
In-firm qualification of skilled and unskilled staff in a steel-producing enterprise	Krupp-Hoesch AG Werksbereich Seigen	1.11.89 - 31.12.92
Development and assessment of computer-supported instruction modules for CAD continuing training of older workers (TECA)	Bremen Institute for Construction Technology BIK	1.11.92 - 31.10.93
Workplace-related qualification of skilled and unskilled workers in small and medium enterprises using computer-supported automated production	Vocational Further Training Centre of the Bavarian Employers' Association Nuremberg	1.10.91 - 30.9.95

Experiment	Institution	Period
Flexible organisation in further training for adjustment in small and medium firms using multimedia learning technologies following the example of automated production	IHK Training Centre Grunbach, Remshalden	1.10.93 - 31.3.97
Multimedia and active learning training media to promote independent and action-oriented learning processes in basic training in metal technology	SIHK -- Hagen Chamber of Industry and Trade in Southern Westphalia	1.9.93 - 31.8.96
Qualification of training staff for the development and use of multimedia learning systems in continuing training	IMK -- Institute for Media and Communication, Bochum	1.1.93 - 31.12.94

Model experiments under consideration

Development of vocational skills and self-learning ability based on case studies in a multimedia learning environment in the home for women with families	Bremerhaven Employers' Association/Institute for Science Transfer and Personal Development	1996
Multimedia learning system for further and continuing training of craftsmen in electrical trades	Federal Specialist Teaching Institution for Electro-technology	1996
Development and trial of creative continuing training arrangements for small and medium firms in motor vehicle electronics	ELEKLUFT GmbH	1996
Qualification of further and continuing training specialists for the assessment, development and introduction of multimedia via tele-co-operation	Association for Vocational Qualification	1996
Tele-learning in the countryside	Regen Communal Association for Adult Education	1996

NOTES

1. Today the issues are closer links between basic and continuing training, the integration of general and vocational education, new forms of work and learning with their educational and organisational implications, the possibilities for modular training while keeping to the broad basic training system, and capacity for lifelong learning. Other subjects of discussion are the costs of vocational training, access to basic and continuing training for the widest possible sections of the community and the risks of unqualified young people being excluded from society.

2. Europe and the global information society. Recommendations to the European Council, Brussels, 1994, p. 4.

3. *Ibid.*, p. 12.

4. Booth, Allen and Hamilton (1995), *Zukunft Multimedia: Grundlagen, Märkte und Perspektiven in Deutschland*, Frankfurt/Main, p. 33.

5. Arno Hitzges *et al.* (1994), *Chancen und Risiken von interaktiven Multimedia Systemen in der betrieblichen Aus- und Weiterbildung, Institut für Arbeitswirtschaft und Organisation*, Stuttgart, p. 1.

6. Bundesministerium für Bildung, Wissenschaft (1995), *Multimedia-Chance und Herausforderung*, Bonn; see also *Information als Rohstoff für Innovation, Programme der Bundesregierung 1995-2000* (Rohfassung Stand 6.1.1995).

7. *Op. cit.*, p. 18.

8. European Union, White Paper on education and training. Teaching and learning. Towards the learning society.

9. Europe and the entire world are confronted with the spread of information technologies, the globalisation of economies and rapid scientific and technical advances. A few examples of the new challenges are the change in production methods and organisational structures, the transfer of production capacity abroad, different employment structures with an extremely varied labour market, different kinds of work, general uncertainty about future developments, and the increasing importance of science in every branch of society. According to the Ellis White Paper, the best way of responding to the challenges of the information society, the globalisation of economies and the new scientific and technical civilisation, is to give citizens access to general education and accordingly the possibility to grasp the meaning of things, to promote understanding, creativity and the ability to make judgements and decisions, and to improve employability.

10. European Commission, Directorate General XIII, Multimedia Educational Software Taskforce (1995), "Educational multimedia: first elements for reflection", Second working document, 22 November.

11. Uwe Grünewald and Dick Moraal (1995), *Kosten der betrieblichen Weiterbildung in Deutschland, Ergebnisse und kritische Anmerkungen*, Berlin. In this paper the cost data are simply orders of magnitude. More accurate data would require detailed explanations. Grünewald and Moraal stress the weaknesses of the survey methods used so far. On the quality of continuing training, see, for example, Richard von Bardeleben (1995), *Weiterbildungsqualität: Konzepte, Instrumente und Kriterien, Bericht zur beruflichen Bildung*, Heft 199, Berlin.

12. Uwe Grünewald and Dick Moraal, *ibid.*, p. 12.

13. European Information Technology Observatory (EITO) quoted in *MultiMedia 1994*, Heft 12.

14. DM, Das private Wirtschaftsmagazin, MultiMedia 95, Ergebnisse einer repräsentativen Gundlagenstudie, erstellt durch IRES Gesellschaft für Ungternehmens-, Marketing- und Kommunikationsforschung mbH, Düsseldorf.

15. IDC Optical Publishing Industry Assessment, quoted in *MultiMedia 1995*, Heft 7.

16. Infotech Optical Publishing Industry Assessment 7th Edition, quoted in *MultiMedia 1995*, Heft 3.

17. Landesinstitut für Schule und Weiterbildung SOEST, Datenbank SODIS.

18. Vocational training programmes available on CD-ROM and on on-line services will be listed and described in a catalogue which is financed by the Federal Labour Agency and is to be published by PW-Verlag of Nurnberg in early 1996.

19. *MultiMedia 1995*, Heft 12.

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ITALY -- AN "INFORM-ACTIVE" LEARNING ENVIRONMENT

by

Graziella Tonfoni[1]

This paper is concerned with the design of "environments" for lifelong learning. It argues for the importance of approaches to teaching which enable learners to develop the skills of reflecting on and understanding their learning as the same time as acquiring knowledge and skill, and for allowing a range of very diverse approaches to learning to be available within a common framework. It proposes the notion of an "inform-active" learning environment as a means of doing this, and describes the application of this approach to a specific group of learners at the University of Bologna.

Inform-active learning

The term "inform-active" is used in this paper to describe any kind of learning tool, ranging from manuals and textbooks to educational software, which has been organised and structured not only to transmit the knowledge itself, but also to explicate the mode of information packaging (see Figure 1 at the end of the paper). The theory of language on which it is based is described in Tonfoni (1989-94).

An "inform-active learning environment" is a cognitively integrated set of learning tools of different kinds, old and new technology together, which are organised progressively to optimise the different kinds of learning to be promoted (Figure 2).

On accessing each tool, the learner is informed precisely about the kind of learning he/she is going to be exposed to, as well as about the kind of information packaging and density of knowledge presented in a manual or piece of software. Explicit directions are given, to link this to other resources, including alternative modes of information packaging and different "densities" of knowledge. Inform-active learning environments are therefore specifically planned and designed to present and represent information in a way, which promotes and supports active participation by the learner (Figure 3).

The guarantee of active participation lies in careful planning of learning resources, based on a redefinition of the knowledge to be "cognitively reengineered", before introducing new technology, since such technologies are not in themselves a guarantee for enhancement in learning: without previous design, they may actually incorporate confusing knowledge, triggering inappropriate learning attitudes, which may collapse altogether instead of leading to better understanding.

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Inform-active approaches, whether applied through hypertext technology, teleconferencing, restructured manuals or textbooks, are designed to promote multiple viewing, interactive and asynchronous learning, groupworking and collaborative planning, based on the theory that the technology alone is not sufficient to produce interactive learning, which is only truly possible if the learner has already started a process of self reflection designed to create awareness of the processes of learning itself (Figure 4).

Only through an active approach, involving a redefinition of knowledge domains and reflection on learning will a satisfactory level of interactivity among and throughout the new technologies be possible. Inform-active learning environments are therefore the product of careful planning, collectively and co-operatively organised by teachers, experts in the field, knowledge engineers, education operators and last (but not least) by policy makers. Only through a commonly shared project, will it be possible to plan consistently integrated inform-active learning environments, using all the different media (Figure 5).

It follows that a primary issue to be addressed is what kind of knowledge will have to be packaged to enable the learner to navigate through the different resources and tools available (Figure 6).

Educational planners therefore need to make decisions about both the quantity and quality of information, working in partnership with specific knowledge experts and providers as well as knowledge managers and teachers.

Redefining curricula, defining new occupational profiles, and identifying newly established targets and information needs to be fulfilled, are all important aspects of the development of inform-active learning environments.

Inform-active learning environments are also highly relevant to the development of lifelong learning, which involves progressive exposure to a variety of distinct skills, to be mastered at different times and for different purposes, by learners who are themselves very diverse, in learning style and motivation to participate, go back or keep going with a learning (Figure 7).

To take, for example, a typical, and increasingly common, group of adult learners, who are very varied in skills and background, and joining at different times. First they need to work together to share experiences in order to find ways of making their individual contributions and to establish the "ground rules" for interaction. Only then are they likely to be willing to put energy into rethinking and reframing the new experiences they are going through and to be willing to share a common interpretative code, which may make it possible to actually convey meaning, based on the previously reached consensual agreement.

Within an inform-active environment, technology enhanced learning can enable learners to have access to records ("cognitive traces") of other individuals' learning experiences. Learners entering at different times are encouraged to identify differences as well as commonalities, by carefully observing and analysing previous learners' experiences.

The opposite kind of experience can also be promoted, based on the analysis of highly idiosyncratic behaviour. Learners can be stimulated by observation of differences in approaches to problems or defining new procedures, and be both intrigued and puzzled by exploring other learners' very different learning routes and strategies. For example, learners have been encouraged to produce written or software documentation explaining parts of the content after undergoing training and reading of the basic literature. This gives current learners a direct experience of reorganising new knowledge themselves, and by applying the same techniques, they were both acquiring knowledge and observing others engaged in the knowledge acquisition process. The teacher and knowledge manager assists by suggesting specific techniques, and coaching the learners, supporting each in his or her own individual search process as a route to their planned final solution.

This "technology enhanced approach" makes it possible to create multiple viewing texts about a given knowledge domain, multiple targeted manuals, and families of learning support tools, based on background knowledge, supported by the knowledge manager.

CPP-TRS

The CPP-TRS (Communicative Positioning Programme/Text Representation Systems) system is a methodology which I have developed to integrate verbal and visual aspects of language in order to make communicative intentions explicit. The case study which follows is of a CPP-TRS Informactive Project, as the first and more generally applicable example of a type of learning resource, explicitly planned, designed and produced to facilitate learning of a practical ability, in this case the mastering of basic CPP-TRS skills to be applied to the enhancement of writing, reading and communication skills.

The competence to be acquired was both theoretical (25 per cent) and practical (75 per cent), due to the nature of the material chosen and presented. The process is very similar to that involved in the acquisition of the skills of musical performance or fluency in a foreign language.

As in the case of any language learning process, CPP-TRS entails a range of qualitatively different kinds of learning, including:

- memorizing definitions of single icons and single icons themselves, representing single concepts, first being described and then defined (Figure 8);
- recognising different combinations of icons, requiring specific matching of newly acquired skills with corresponding examples previously memorized in their essential traits and then retrieved (Figure 9);
- creating new and consistent combinations, and making sure that basic rules are apprehended, recognised and then applied correctly, according to relevant previous experience (Figure 10);
- combining icons, which may then be interpreted and attributed meaning in a consistent manner, as is required in the interpretation of musical notation and performance cues (Figure 11);
- interpreting cases, to be integrated and represented through the system of icons, with no indication or further explanation, in the same way as a physicians' diagnosis is followed by consistent therapy (Figure 12).

Where learning is primarily concerned with skills acquisition and thus very much "hands on", learners are often able to test the results against their own experience and contrast it with their current ways of writing, reading and more generally communicating. Here there may be a greater need to explicitly recognise and justify the use of the system. The reader may need to have specific information about the author's motivation in planning, testing, etc., as well as evidence of its scientific validation and theoretical background (Figure 13).

In an inform-active environment which offers multiple perspectives and multiple learning strategies, different users select different kinds of knowledge: a learner wishing to master a specific competence will need direct access to that very specific territory of information, previously organised for that purpose and explicitly identified for it. An inform-active learning environment is "new" precisely because the learner will have direct access to that very precise kind of knowledge, by being told explicitly what to expect in terms of knowledge density, learning approach and time commitment.

The four years running "CPP-TRS inform-active learning environment" in Italy have demonstrated a high degree of acceleration in skills acquisition, made possible by intense and accurate planning by the teacher and knowledge manager, both in the organisation and presentation of textbook material and software and in ongoing training (Figure 14).

Without a consistent preparation of the study material which learners will access, by an "inform-actively" trained teacher, learners will never really be able to profit fully from the experience.

The use of the term "inform-activity" is intended to imply that, like a nuclear reaction, once the process has been initiated, it will go on by itself. In the same way, it is the result of an extremely accurate and highly consistent set of preparatory operations: but, once a set of initial transformations has been activated, the reaction proceeds autonomously.

In an inform-active learning environment, learning supports and tools provide explicit directions and guidelines about the kind of knowledge and mode of packaging of information available, as well as explicit definitions of the kind of learning provided.

An agreed structure for interpretation and mapping of information territories and knowledge domains is thus transportable between different media, and once the time has been invested in planning and redefining a knowledge domain for lifelong learning in an inform-active environment, it will remain permanently available as a foundation for continuous growth and updating. It is in other words a cognitive investment in the various resources and learning tools, which will link all of the actors playing different roles in the learning process, making consistent descriptions and evaluations transportable and fully understandable across the different media, languages and cultural contexts. The learner thus becomes skilled and cognitively aware at the same time: direct participation is required in order to keep the two levels of learning active all the time with no overlapping or confusion. The learning process will actually turn into a multiple-skills and cognitive-awareness process without any interference, and it is directly monitored by the inform-actively skilled teacher (Figure 15).

Inform-active learning, based on both redefinition and pre-definition, may then be extended to the different media; knowledge organised accordingly may easily be transmitted throughout the different learning technologies. Cognitively sound pre-packaging of knowledge, based on redefining occupational profiles, as well as both quantitative and qualitative decision-making about learning routes, will allow the learner to actively monitor the process of new knowledge and new skills acquisition autonomously (Figure 16).

Any "inform-active environment" is by definition based on a technology-enhanced approach, but one where technology is harmoniously incorporated within a more global redefinition of the overall learning process.

Any inform-active learning process is outcome led: the learner is informed in advance about both the quantity and quality of knowledge available as well as the kind of skills to be developed during the process. Indications will also be provided about the nature of each learning tool available, so that the learner will be able to assess and use each, fully aware of the underlying learning approach, thus becoming able to monitor and directly control what is happening during the learning process.

The reason for describing the CPP-TRS case here is that it provides the first example of an "inform-active environment" now available.

Simplifying and amplifying approaches

Learning technologies may be thought of as tools to simplify learning. From this, content and performance driven, perspective, the most important issue is to achieve the predetermined goal. A simplifying approach is based on defining learning routes and consistently, step by step, observing the acquisition process. An amplifying approach is based on a pre-organised two layered approach, where the first layer is the process of acquisition, planned and consistently organised ahead, and the second is the learning experience itself, organised in such a way as to be fully visible to the learner.

Whereas a simplifying approach may well guarantee fast and effective content and skills acquisition, an amplifying approach will add to this an awareness of the acquisition process which is transportable to other learning processes, or which can be used as a tool to enable the learner to identify differences, and collaborate more effectively with others with different learning styles.

A simplifying approach is cheaper and faster at a first glance, than an amplifying approach, which necessarily implies a slowing down of the processes and double checking of each step. If acquiring skills quickly is the primary goal, a simplifying approach may be the one to choose, but if the aim also includes acquiring the skill to manage one's future learning autonomously, then an amplifying approach is the best guarantee of continuing learning. Nevertheless, an amplifying approach is not designed for the "shortcut learner".

In an amplifying approach, the learner will actually be able to experience a whole variety of learning supports, as well as a whole set of information packaging modes, and can be advised at any stage about the cognitive nature of each learning support being presented. An "inform-active learning environment" is strongly based on an amplifying approach: supported by a carefully planned range of learning tools.

The creation of a consistently "inform-active environment" calls for careful defining and redefining of training requirements, differentiating learning tools and supports as well as describing and classifying the knowledge resources available. Overlaps or contradictions which may arise in the construction of the overall learning environment will have to be explained and declared if they cannot be fully resolved (Figure 17).

Any tool made available to the learner will have to be presented for its learning value. Skills required will be repeatedly indicated to make sure the learning progression is correctly explained and that consistent expectations are being created.

One of the main goals of "inform-active learning environments" is to provide different kinds of learners with the appropriate information needed to navigate among and select the correct learning tools and training supports according to their respective learning styles and personal or professional needs.

On first contact the potential learner and advisory system "Scuola Guida" (literally a "driving school") helps learners make the most appropriate decisions about scheduling their training, finding the most suitable supports and organising their own learning route, realistic planning of time being a very important aspect of the overall learning process. Different resources for different kinds of learning are presented in detail.

After having got a global idea about learning facilities, the individual learner is supported in organising his/her own learning path. This comes as a result of accurate interviewing, aimed at tailoring learning to each individual's needs, desires, and goals. The interviewing process is a very important stage, organised by a "tutoring interviewer", who is also part of the training staff. After a two-hour interview process, monitored through a CPP-TRS based questionnaire, the "tutoring interviewer" is able to analyse the information gathered from the learners, process the questionnaire and report results to the knowledge manager, who will then be able to direct the learners to the most appropriate facilities available, by visually mapping his/her future learning path and trajectory and estimating the approximate learning process time as well (Figure 18).

Since each of the learning facilities is equipped with very specific information about the quantity and quality of knowledge presented as well as about the kind of learning promoted, the learner will actually be able to monitor his/her own learning progress, consciously recognising the different kinds of learning experiences, which are being indicated both visually and with a commonly recognisable terminology, which is represented by CPP-TRS icons and definitions (Figure 19).

Once acquired, self-reflection and self-observation capacities provide individuals with a high degree of personal control over learning progress and achievement. Assistant staff as well as inform-actively trained teachers will be able to support the two-layered training process and consistently tutor learners. Even if assistant staff are not involved in planning of the inform-active environment, interviewers will be able to indicate where to find information about the past experiences of other learners, thus allowing current learners to compare their learning experience and output with other learners, who may be asked to leave their comments in the form of self-reflection.

Inform-active learning environments do not represent a homogenising of different learning approaches (a "blender" model), but rather a highly consistent and visible co-ordination of many learning tools. Careful planning is therefore needed for the construction of the "inform-active learning environment", which in many ways resembles the planning of a complex construction or building. The planning and construction of an inform-active environment will be carried out by a team, comprising specific knowledge experts and teachers in order to obtain correct and consistent inform-active material, as well as specific indications about the quantitative and qualitative choice of knowledge (Figure 20).

In different knowledge areas, subject experts need therefore to be carefully identified and selected to plan expert "knowledge constructions", which incorporate vast amounts of existing complex and fragmented knowledge, to be then redefined, pre-processed and carefully and consistently reorganised. This reorganisation is the precondition for consistent re-engineering of careers, job typologies, tasks, cognitive profiles and knowledge transfer, transport and transmission. If the CPP-TRS inform-active environment can be described as a whole new construction designed by a single architect, inform-active learning environments in different areas of expertise and in different fields would better be described as the product of restoration and integration of already existing bodies of knowledge, under the supervision of a team of experts.

Bodies of knowledge can thus be viewed as "buildings". Different knowledge buildings within the same inform-active environment are meant and designed to represent qualitatively and quantitatively different kinds of information packaging, each supporting and facilitating its distinct kinds of acquisition processes, both on a quantitative and qualitative level.

The CPP-TRS Project at the University of Bologna

Some data and more specific information

The CPP-TRS project at the University of Bologna set out to expose a variety of learners to CPP-TRS training. The group consisted of 80 high-school teachers from different disciplines, 200 students, and ten technical writers. The aim was to give them CPP-TRS expertise for use in technical documentation and information processing and in high-school level teaching in communication skills (reading, writing and selecting information for processing).

The project was officially approved by the University of Bologna, and the National Research Council. In addition to the main aims, it provided ongoing access to the CPP-TRS inform-active learning facilities, located in Bologna, for CPP-TRS trained high school teachers, wishing to become future trainers. The facilities were also offered with tutor assistance to university students wishing to develop specific skills in writing technical text, to journalists and information experts, and those simply interested in exploring the nature and principles of the methodology and this new way of organising the processes of knowledge acquisition. Assistance was provided in various forms, ranging from learners' volunteering support, through to visits guided by the author.

The "expert" (in this case the author herself) selected a number of individuals, representative of the various kinds of learner, and organised for them a set of intensive and personalised training sessions. No resistance was shown by individuals to the intensive training, which was based upon direct interaction and tutoring with the expert and knowledge manager. Relevant material was also provided, together with software supported training, to reinforce the basic knowledge, which had been previously provided in books, articles, and documentation directly by the knowledge manager.

A range of qualitatively and quantitatively different knowledge sources had been designed and organised to be inform-active; incorporating specific indications to trigger qualitatively different learning approaches, interactive segments and inform-active trajectories, in order to promote cognitive awareness alongside content and skills acquisition.

As a direct consequence of a very intensive and personalised tutoring, learners who were exposed to multiple sources of knowledge, consistently pre-packaged expertise, and pre-filtered information were able to develop CPP-TRS skills fast and effectively. Twenty hours of tuition was adequate to acquire and consolidate the basic skills.

In the pilot phase, the knowledge manager organised tests of skills and the ability to master the new inform-active tools. An effective way to test was actually to have learners actively react to proposed examples, incorporated within the various books and software, in real time. Examples were provided and commented on directly by the author and knowledge manager.

At this stage the training deals very specifically with developing interpretation skills and examining the validity of multiple interpretations; as is commonly done in the teaching of music. Learners were encouraged to approach learning tentatively and gradually in order to avoid confusion and misunderstanding. In a sense, learners were slowed down intentionally by the expert, knowledge manager and supervisor in order to promote both the acquisition of CPP-TRS basic skills and a cognitive awareness of what and how they had been learning. Thus the process was seen as much more than mere transmission of knowledge, calling for a high level of participation by the author, knowledge manager and supervisor.

As a result of this intensive teaching, learners were naturally developing a two-layered approach, resulting in fluent performance. Every sequence of actions was complemented by consistent reflection on the cognitive processes and operations involved, with the result that any further example produced, would stimulate the same two-layered approach. As a direct consequence of these highly specific, intensive and personalised training sessions, learners given different tasks, produced texts which naturally evolved into partial manuals incorporating those aspects of the methodology, which each learner had been specifically assigned to report on, together with comments and cognitive self-reflection about how such results had been arrived at. Rewriting has thus been an effective way to test acquisition of the two different but coexisting levels, therefore representing a double checking tool to ensure both quality and quantity of knowledge.

Trainees coming out of such intensive learning experiences were able to identify different cognitive styles in themselves and in other trainees. Since their contributions were in some cases significant for future comparison with the learning of others, they were themselves incorporated into the "inform-active learning environment" and preserved as cognitive traces for further learning by observation and comment. In this way, incremental inform-active learning experiences, in the form of additional software or extra tutoring tools of various kinds were created.

Although some had started the process with almost no technological skills or knowledge, the programme established a common basic level of technological literacy. The entire community of learners exposed to the CPP-TRS inform-active learning experience was offered a complementary introductory course in basic technology skills, and this was supplemented with direct assistance from already technologically literate learners, who not only helped the newcomers but consolidated their own knowledge through the experience of tutoring. Sharing a certain set of basic skills in this way helped to create a solid base for further co-operation and group-work within the inform-active learning environment. A record was kept, in the form of reports, videotapes and audiotapes, of those aspects of learning and group-working sessions which were found to be particularly relevant.

The classroom becoming inform-active

The author began by explaining to the learners, all with different backgrounds and skills, that they would become a visible example of how learning may be turned into a collaborative experience, where each partner may take care of a particular piece of knowledge transfer, referring to other agents for new skills acquisition or other kinds of information, which had been previously supported by the knowledge manager. Individuals learning were thus themselves experiencing direct responsibility for accurate knowledge transfer which would be finally checked and approved by the author and knowledge manager. Learners undertook their sub-projects and were themselves asked to report in a written form to the knowledge manager on actual achievements. Problems in knowledge transfer were identified and corrected, in the course of timetabled interview sessions.

Inconsistencies in knowledge organisation or errors were first identified, defined and finally solved on the basis of a process of self-reflection. Learners would then, in turn, take on the role of tutor, reporting and commenting on the results of partial learning paths. The methodology itself provides learners with a set of visual representation models and schemes to describe the qualitative aspect of knowledge and interaction to be organised, using standard schemes developed by the author as tools for the sharing of interpretative cues within larger communities. From time to time the author was asked to verify results progressively, check the correctness of data, and the soundness of self-reflection, and to assign more tasks by indicating more specific references and sources of targeted information, according to the specific information and knowledge needs, as they emerged from group-working sessions. "Ad hoc" learning technologies were proposed after having assigned specific tasks. Technology was intentionally being presented as a fundamental resource for decentralising learning and tutoring and for promoting cognitive awareness, by integrating it with previous learning experience reports and comments. Traditional exercises were never added, since interactivity was seen as the final result of inform-activity, and inform-activity is itself a highly complex skill to be progressively developed after a trial and error process and through active learning.

The classroom has thus been conceived as a "cognitive space" to be filled in progressively with knowledge constructions and knowledge buildings, according to a plan which reinforces already acquired skills, thereby allowing the learning experience to be transported into the different media.

Any "knowledge building" to be organised and added to the "inform-active environment" was planned, checked and positioned under the direction of the author. It was then designed, planned, and approved for content accuracy. Each knowledge building was designed for a very specific teaching or navigating function. Some are tools for navigation among a set of different books or manuals: in the form of software or a booklet. Other knowledge buildings are tools for the acquisition of specific skills, which might lead to the production of multimedia applications. Some knowledge buildings have been conceived as expansions of previously organised learning tools like basic books and basic software directly from the author, and represent some integration of "learning by listening and reporting" directly originated by the author, in the course of intensive-training sessions or during some monitored interview sessions.

A set of software applications were designed to complement intensive-learning sessions and guarantee the consolidation of knowledge. These were based on the following basic assumptions about the teaching and learning implications of the CPP-TRS methodology:

- any inform-active environment will produce a significant acceleration in information processing;
- in any inform-active environment, learning technologies are chosen on their ability to meet "low cost and high achievement";
- inform-active learners are likely to become inform-active teachers;
- inform-active software is intended to slow down processes in order to speed up results;
- inform-activity will be easily transportable across the different media, technologies and languages;
- inform-active software is mostly the result of compressed intensive knowledge transfer by the author and knowledge manager to some trainees, whose experience demonstrates that a specific knowledge acquisition process has actually occurred;

- inform-active software may be effectively developed by teams of learners each of whom has both commonly shared and individual learning experiences in knowledge and skills acquisition;

- inform-active software could not be produced by any software designer who had not directly experienced an inform-active environment;

- inform-activity is the cognitive grounding for consistent interactivity.

As a result of a two-year CPP-TRS knowledge transfer process designed to create inform-active learning facilities a set of differentiated inform-active software products have now been produced. These include:

- CPP-TRS Spot:

One learner has become a trainer, reorganising existing inform-active material, in a hypertext browsing and navigating tool.

- Prova di Orchestra, PdO:

40 learners rewriting inform-actively a 120 hour inform-active learning exercise, which was subsequently converted to hypertext.

- CPP-TRS navigation tools:

Five learners integrating existing inform-active material to create an "ad hoc" inform-active hypertext to practice some basic CPP-TRS techniques.

- Cartellone:

Five learners converting inform-actively an existing inform-active book by the author into a multimedia application (Sistemi Cognitivi Complessi, SCC).

- Lettura Strategica, LS:

One learner creating a hypertext version of a book (Lettura Strategica) on reading skills enhancement describing an inform-active knowledge transfer by the author to a previous learner, reporting and rewriting his learning experience. The new learner reported analytically on a comparison between his own experience and the previously observed and analysed one.

From "mosaic" information to "puzzle" knowledge

Learning resources available today usually embody a "mosaic" approach to information, reflecting a "collage" of different skills. However, simple exposure to varied resources without definition, consistent planning and filtering does not guarantee actual growth in the skills of knowledge management.

Learning technologies entirely designed and based upon a mosaic information and collage learning approach, will directly reproduce and further stress a "blender" approach towards organising bodies of information which are quantitatively and qualitatively different. An "amplifying model" on the other hand, will explicitly organise and represent information as a puzzle and learning as a game of dominoes.

Mosaic and Collage approaches are based on a pre-defined and pre-planned picture, which cannot be changed, whereas a Puzzle and a Domino, even if both reflect an overall project and a pre-planned and redefined structure, trigger a more complex search for combination and a highly articulated process of self-reflection. Since final achievement is the result of multiple selection processes and decision-making, learning, like a puzzle, may begin from many points.

Learning within an inform-active environment allows different learners with very different skills and backgrounds to start their acquisition process at any time from multiple entry points, while being tutored and supported to proceed consistently according to their knowledge and skill needs, basic skills and learning styles. As a consequence of two-layered and multiple target learning, skills acquisition becomes a complex and articulated set of highly differentiated paths. A group-working approach is strongly supported and favoured under the supervision of the knowledge manager. Having become both technically skilled and cognitively aware, trainees are highly motivated to engage in co-operative learning sessions based on mutual monitoring.

The final outcome is the "learning by teaching network" whose experiences, may be transported through the different contexts, languages and media, including old and new technologies.

Information superhighways integrated by "knowledge circles"

What is missing today on the information superhighway is a sound, shared and consolidated code for helping drivers identify, name and recognise routes and directions. There is also still a missing link between the worlds of information technology and learning technology (Figure 21).

A solution to this may be to conceive of learning in terms of "knowledge roundabouts", where one deliberately slows down the learning "traffic" in order to promote new knowledge and new skills acquisition by increasing awareness of the processes themselves. This may be the only possible way to guarantee effective speeding up of traffic on the information superhighways. Knowledge roundabouts may be harmoniously integrated with information superhighways to allow consistent information packaging to be transportable and recognisable worldwide. Knowledge integration, interactivity and effective sharing and transportability of different kinds of information will therefore work only if based on qualitative knowledge processing.

The evidence of the CPP-TRS project suggests that such a change can lead to a more harmonious linkage of education and technology. We found that:

- Trainee interest was very high.
- Enhanced learning was perceived as one possibility and not as the only way, therefore facilitating an open and spontaneous approach.
- Trainees felt very comfortable trying the learning technologies, because they neither felt compelled to participate, nor tested; curiosity and spontaneity therefore constituted a powerful incentive.
- No one ever refused the technology support.

- Some more technologically-skilled trainees actually proposed, after the basic training, to integrate already produced and available software, bringing information and data from their own learning experience (30 per cent).

- Some proposed and actually built new software, by reproducing their own learning experience starting from scratch (20 per cent).

- None remained technologically illiterate even if the basic courses were presented as complementary.

- All trainees expressed the desire to improve their skills in order to better grasp and share the inform-active learning experience in all of its dimensions.

- Pre-service training for staff acting as instructors in the inform-active environment was conceived as a set of interviews on knowledge resources available and accurate self-observation about one's own learning processes.

- No technology skills levels were specified for entry to the inform-active environment experience.

- Training was supported immediately, after selection based on differences of background knowledge, training needs, and professional profiles.

- Participants were not distinguished on the basis of their ability to operate the technology.

- Those semi-literate in technological skills performed even better than others who initially perceived themselves as technologically skilled.

- Instructors (*i.e.* trainees who had become trainers themselves), played a very active role in redefining new possible subpaths for learning, by incorporating their own previous learning experiences.

- Trainees achievements were measured according to their self-reflection processes, their redefinition of content packaging and their own transferring of previously acquired knowledge within the inform-active environment.

- External dissemination of techniques and abilities proved to be extremely effective: trainees immediately became involved in projects in different fields and disciplines aimed to reorganise knowledge inform-actively.[2]

Any individual inform-active learning environment can be linked up with others, because of the common approach to information and the existence of a common set of interpretative tools, which provide a shared framework for comparison and data gathering.

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[2] The Headquarters for all inform-active learning experiences is the CPP-TRS Laboratory, presently located in Bologna (Italy). Many other highly specific projects of knowledge transfer were initiated by the author: the Technical Writers Project at the Polytechnic of Hannover (Germany), the High-School Teacher Training in Baleares (Spain), differentiated Teacher Training Sessions in Milano, La Spezia, Venezia and Ferrara (Italy). A rather intensive knowledge-transfer was initiated by the author in the Los Angeles area (US) as well.

By using Knowledge Roundabouts to reorganise different knowledge domains, the newly organised and packaged information becomes transportable and ready to be linked consistently with Information Superhighways technologies.

Where are we now? Some general observations

Development in learning technologies is usually seen in highly quantitative terms. There is a rapidly growing number and range of technological tools available, data, information and knowledge are expanding and diversifying, while a whole set of different procedures, methodologies and curricula are emerging. This calls for very different and ever changing skills, some of which are clearly visible, while others are evident as limitations or gaps in technical training, without being necessarily defined and described.

At present we have a range of coexisting approaches to this problem, reflecting different design criteria and different kinds of interaction with technologies. Availability of diverse resources together with the need to identify widely acceptable standards seem to be " two sides of the same coin". Trends towards compatibility and diversification are apparently contradictory aspects of a complex ever changing situation, which leads both to a search for a new identity and to a need to preserve cultural, social and linguistic identity.

There are some common patterns in the reaction of learning institutions to the technologies. Among those is an effort to be constantly up to date with the latest technologies available, and to be both informed and skilled in their use. There is also a perceived need to develop new professional roles: like new communication experts, able to help the institution to establish itself competitively in relation to its rivals.

Crucial needs include ongoing teacher training and support, and the collection of relevant data in order to compare the performance of educational institutions, and to evaluate the changes resulting from the introduction of technologies. One basic need is for training in the skills to manage and reflect on change itself.

Evaluation procedures, as well as so called "evidence", typically present information which is too complex, and which relates to contexts which differ so dramatically that they cannot be fully understood, processed and consistently interpreted. Gathering data and evidence is pointless if it is not based on adequate definitions, on an understanding of the reasons for collection, under what kind of constraints on which theoretical bases, and with which practical tools. New categories and new terminology are needed, to ensure that descriptions of a much more complex and dynamically evolving situation can be fully interpreted and therefore shared. Categories, behavioural attitudes and even basic terminology which analysts, experts and policy makers currently use, need to be reviewed, to ensure that they are really commonly shared. This calls for a "slow down process" and is not a cumulative activity: new words, new skills, new methods, and new forms of interpretation are required. This redefinition is a process of reorganising knowledge to seek clarification and transparency. Redefining curricula, roles and skills means recognising explicitly what has changed, and how far it has done so, by fully explaining "old" and "new" conditions. In some cases, it is may be important to describe very precisely what existed before but remained undefined because it was unnoticed, or the change has been hidden by continuous evolution.

Educational institutions and policy makers are therefore confronting something which affects them directly. They are not just controlling and analysing an external process where they can call on expert opinion, they are themselves living the new experience and learning through it. In place of an established body of consolidated knowledge about education and learning technologies, we have a mass of data and facts, which have been processed according to a wide variety of different criteria, which make experiences neither compatible nor comparable. This is due to the current quantitative approach to information organisation.

The preliminary phase of the information era required a quantitative approach to information, but we are now entering a more advanced period, where we need to face the problem of restructuring knowledge and reengineering curricula as well as learning styles, which require a much deeper rethinking, reframing and reorganising of knowledge, and knowledge representation systems.

Case studies and statistical data cannot be the only means of validating a methodology. There is rather an urgent need to find different and consistent ways in which to measure different experiences, as to be able to cope with high complexity of elements and factors, some of which still remain unrecognised. Data and information becomes knowledge and experience only when it is interpreted in ways which can be conveyed to others because it is based on a commonly accessible framework for interpretation.

Being able to report on case studies and applications of technology to learning, country by country, means finding common problems to solve collectively, based on sharing of decision-making on crucial issues, identification of standards, compatibility of technologies, and acquisition of technical knowledge. Reporting on cases also calls for a common language to make experiences truly transmittable. It may sound contradictory, but it is not: sharing a common terminology and interpretation framework is the only actual guarantee for identifying real differences, which will reflect differing and valued, cultural contexts. In order for their uniqueness to be fully understood, different experiences in learning technology need to be defined, described and explained on the basis of a shared frame of reference. A process of interpretation takes place as the result of a "slowing down" procedure of redefinition, which is in itself a learning procedure and provides a basis for sound and consistent planning for future actions. In the long term this will lead to a "speeding up" of learning and understanding.

What can be done through "inform-active learning"?

When I first started planning an inform-active environment for raising writing and reading skills, the first step was to establish primary goals and techniques, which could then be transported and extended to other learning situations with different contexts and contents. A CPP-TRS Training Programme had been already running for two years, based on training sessions with textbooks but no technology. I had designed, planned and organised the programme to enable learners to actually experience different kinds of learning applied to the same content. This very first step in the acquisition of CPP-TRS was specifically meant to promote a "cognitive awareness" process in the learners, to lead them towards an understanding of how the same content could be presented in different ways, and how different individuals differ in their cognitive attitudes and preferences in writing, summarising, reading and packaging information.

Recognition of different attitudes shown by different individuals led to the need to consistently name what was being observed, leading naturally towards the use of the visual language supported by the CPP-TRS Methodology. Recognition of different attitudes also led to the need to capitalise on the different knowledge processes, which had been first observed and identified and then named and described. A practical way to retain traces of those learning experiences, was to represent them visually, in order to be able to compare ongoing learning processes with previous knowledge acquisition processes based on the same content and the same kind of competence.

Only at this point did the technology enhanced learning approach become an effective solution to the problem of capitalising on previous learning and teaching experiences by making them available and transportable, having previously incorporated them within the technology. Since I had previously organised teaching material and selected a set of particularly significant learning paths to be shown in detail and I had also been the teacher and trainer, the first phase of developing an inform-active environment was very much "teacher and knowledge manager directed". In future stages of the process, the role of the teacher and knowledge manager will progressively be reduced, to allow learners to become active after and not before an accurate inform-active knowledge transfer occurs.

What is missing in a traditional technology enhanced learning environment and is absolutely crucial within an inform-active learning environment is the reformulation and reframing of the overall learning experience, based not just on the content but on a consistent visualisation and interpretation of the previous organisation of that content. It also uses, as powerful learning resources, reflection on the different learning processes, including the breakdowns and difficulties which previous learners had experienced. The visual representation of different past experiences of knowledge acquisition makes it possible for actual learners to better perceive their own difficulties in knowledge transfer by being able to observe what had happened to other learners.

Technology provided the means to capitalise on this previous experience, promoting "learning by observing others' learning". Not only would the designed inform-active software keep consistent records of previous learning processes, but it would also trace back analytically how problems had occurred and how they had been interpreted and solved. Significant breakdowns could then be selected by the teacher and knowledge manager and consistently identified and presented as problems to be solved by actual learners, thus creating a "learning by teaching" experience as well as group working attitudes. Specific techniques out of the CPP-TRS Methodology and Language (Tonfoni, 1989-94) were incorporated in the software: using concepts like "Text Rotation", "Fresco Talking" and "Tapestry Writing" to enhance learners group-working skills by observing previous and actual learners' behaviour as a tool to reflect on their own learning output.

Conclusions

An inform-active environment is like an orchestra, where the CPP-TRS visual language is like the musical score. Both are based on a clearly agreed annotation system for interpretation and execution which enables each learner to play his/her own instrument, performing according to both the respective role he or she has been assigned and his or her personal needs and preferences. Co-ordination is the director's responsibility, but players will practice and exercise individually and in smaller group-working sessions.

The role the teacher and knowledge manager plays resembles precisely what an architect does when designing a building according to its functionality. Only if it is based on a thorough planning will it be possible for construction to be initiated and pursued consistently, allowing asynchronous actions to take place without compromising the final result. Redefining allows knowledge and experience to be transmitted not only through different media, but also through different cultures and languages, without compromising context-sensitivity to the different kinds of knowledge and experiences under examination.

In other words, in order to be able to compare, there is not just a need to record knowledge and experience but to make it transmittable and transportable through the new technology. What is needed is a "common code" for conveying definitions of different modes of packaging information in a way which can be both shared and identifiable by educational policy decision-makers trainers, teachers and learners.

What crucially matters today is "packaging of information" in visible forms, which will allow learners to become fully aware of the nature of the competence and contents they are acquiring. In other words, if any individual who gets involved in a learning process is also provided with conceptual tools which put him/her in a position of actually being aware of which kind of knowledge he/she is acquiring and what is missing and how and when it will conveniently be accessible, then it will become a very natural process for him/her to actually be able to integrate the learning process, which has been initiated, by consistently and autonomously defining his/her own needs and modes of acquisition.

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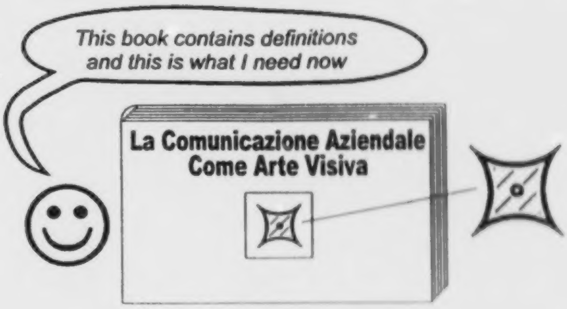

This book contains definitions and this is what I need now
La Comunicazione Aziendale Come Arte Visiva

Fig. 1

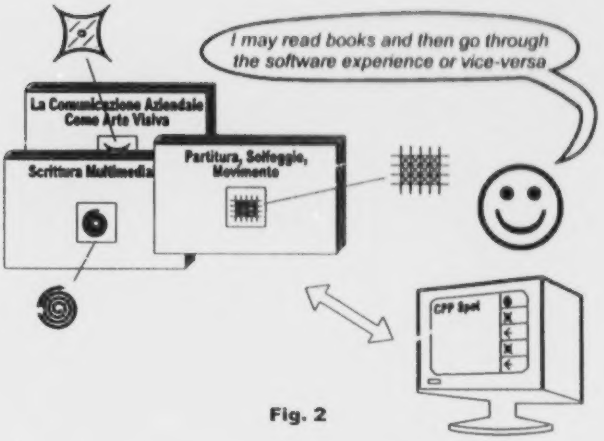

I may read books and then go through the software experience or vice-versa
La Comunicazione Aziendale Come Arte Visiva
Scrittura Multimedia
Partitura, Solfeggio, Movimento
CPP Spot

Fig. 2

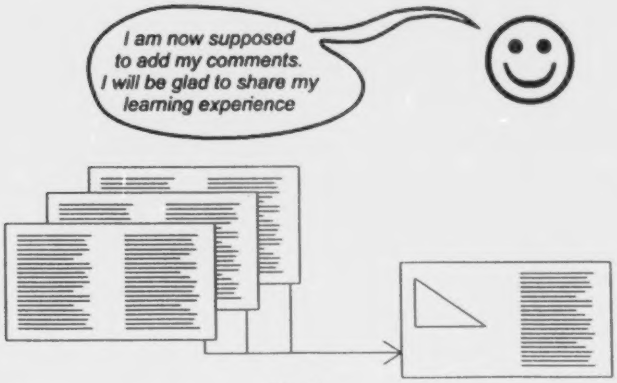

I am now supposed to add my comments. I will be glad to share my learning experience

Fig. 3

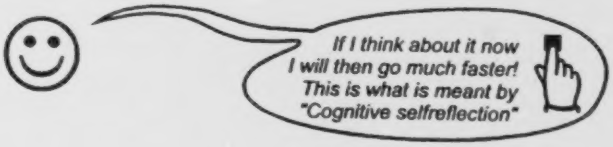

If I think about it now
I will then go much faster!
This is what is meant by
"Cognitive selfreflection"

Fig. 4

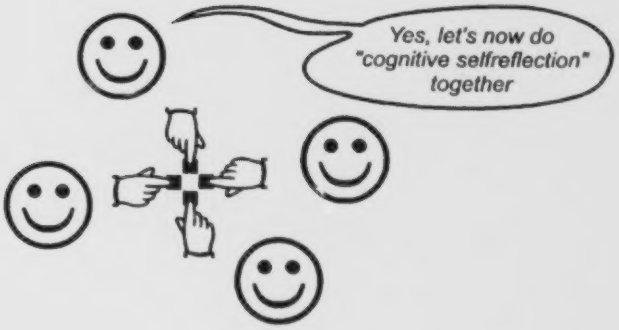

Yes, let's now do
"cognitive selfreflection"
together

Fig. 5

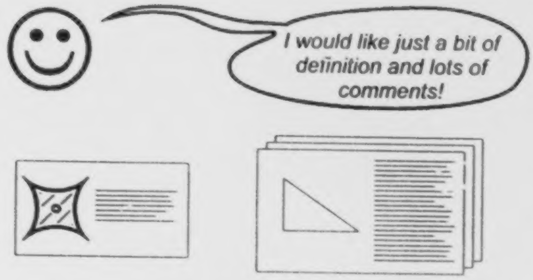

I would like just a bit of
definition and lots of
comments!

Fig. 6

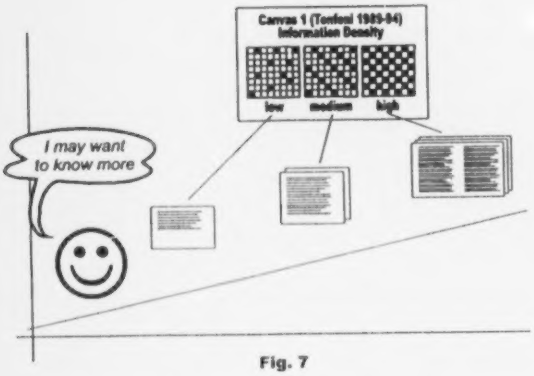

Canvas 1 (Tonfoni 1989-94)
Information Density
low
medium
high
I may want to know more

Fig. 7

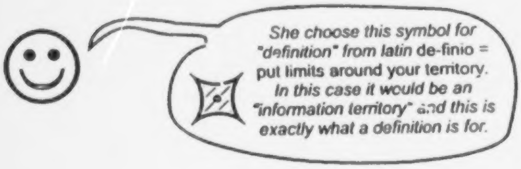

She choose this symbol for "definition" from latin de-finio = put limits around your territory. In this case it would be an "information territory" and this is exactly what a definition is for.

Fig. 8

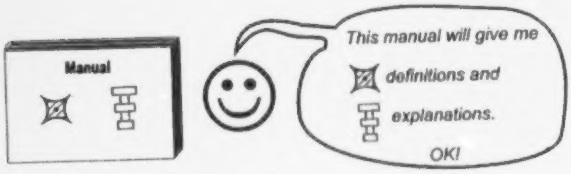

Manual
This manual will give me definitions and explanations. OK!

Fig. 9

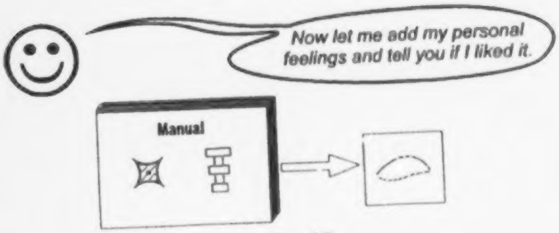

Now let me add my personal feelings and tell you if I liked it.
Manual

Fig. 10

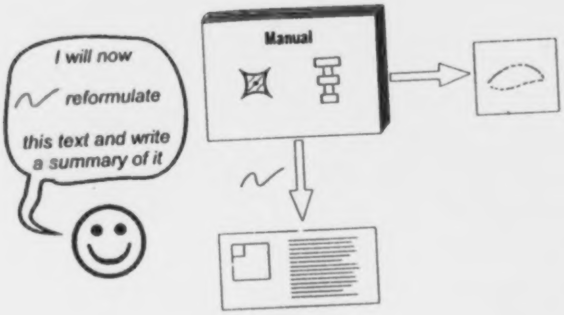

I will now
reformulate
this text and write
a summary of it
Manual

Fig. 11

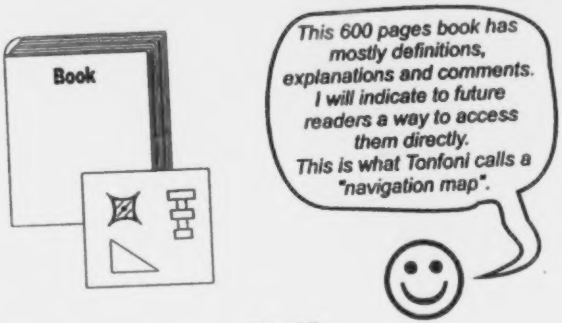

Book
This 600 pages book has
mostly definitions,
explanations and comments.
I will indicate to future
readers a way to access
them directly.
This is what Tonfoni calls a
"navigation map".

Fig. 12

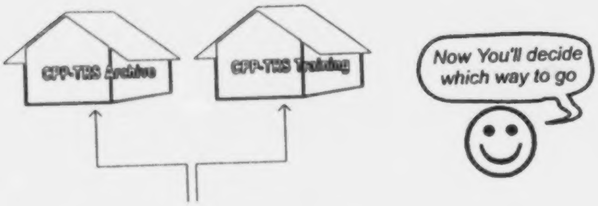

CPP-TRS Archive
CPP-TRS Training
Now You'll decide
which way to go

Fig. 13

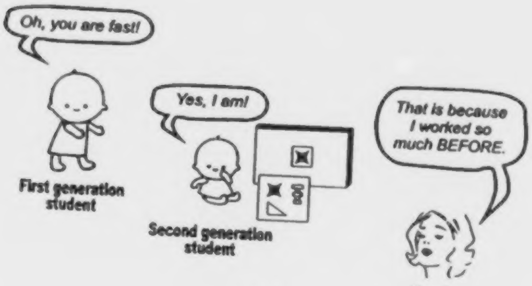

Oh, you are fast!
Yes, I am!
That is because I worked so much BEFORE.
First generation student
Second generation student
Teacher

Fig. 14

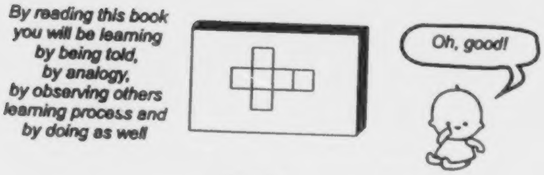

By reading this book you will be learning by being told, by analogy, by observing others learning process and by doing as well
Oh, good!

Fig. 15

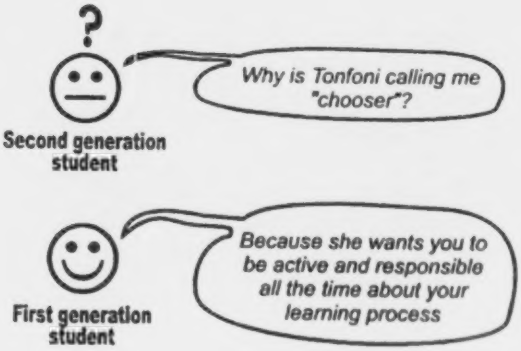
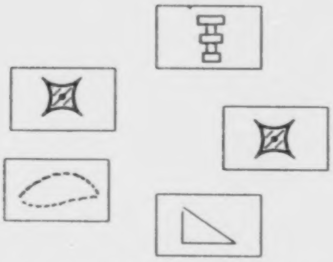

Why is Tonfoni calling me "chooser"?
Second generation student
Because she wants you to be active and responsible all the time about your learning process
First generation student

Fig. 16



Sorry, information territory still under construction!

Fig. 17

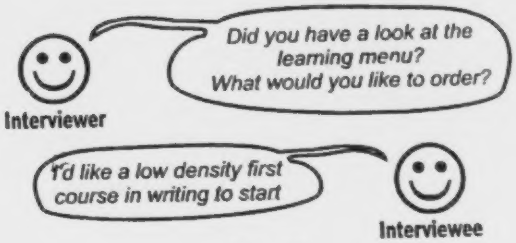
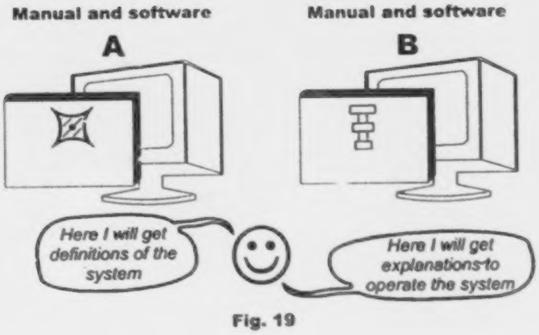

Did you have a look at the learning menu? What would you like to order?
Interviewer
I'd like a low density first course in writing to start
Interviewee

Fig. 18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B
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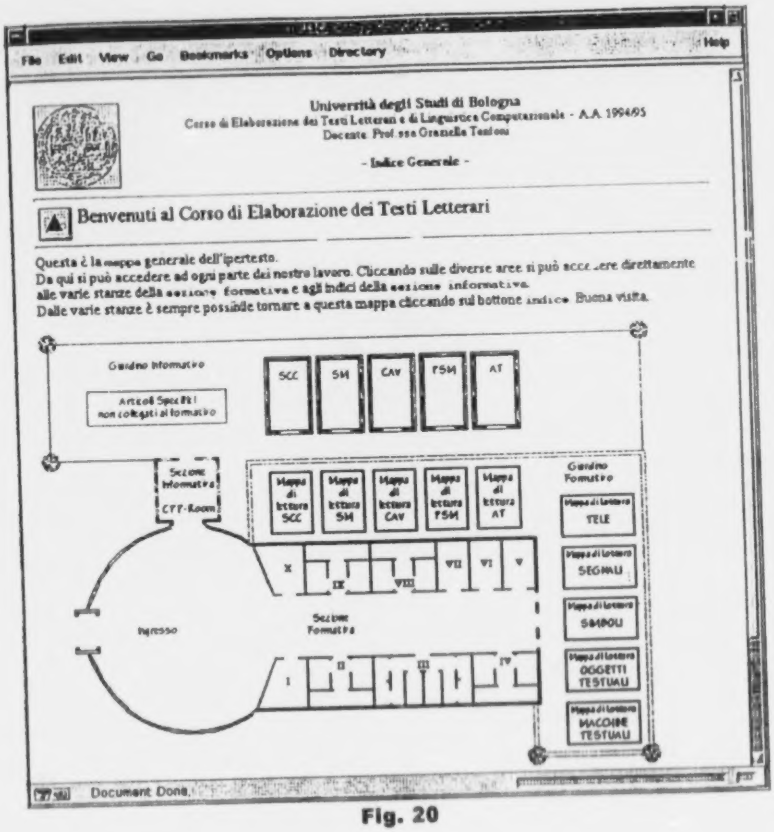
Here I will get explanations to operate the system

Fig. 19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Help

Università degli Studi di Bologna
Corso di Elaborazione dei Testi Letterari e di Linguistica Computazionale - A.A. 1994/95
Docente: Prof.ssa Graziella Tonfoni

- Indice Generale -

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Mappa di lettura OGGETTI TESTUALI
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Fig. 20

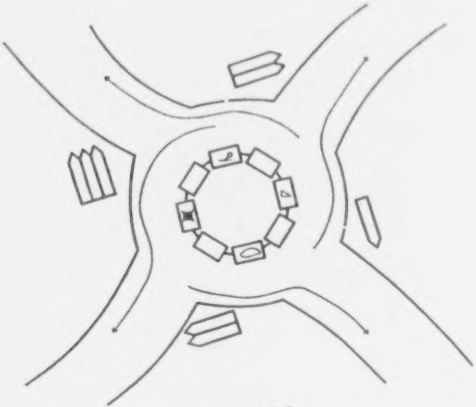

Fig. 21

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JAPAN -- TECHNOLOGY AND HIGHER EDUCATION

by
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Higher education in Japan is facing rapid change in the social environment, and every university is being pressed to reform both the content and methods of education. The use of media technology is recognised as an effective complement not only to the improvement of education methods, but also to the development of a new model for higher education.

This report describes the experience of higher education and media technology in Japan in four parts: current trends on higher education and media technology; a case study on higher education systems using media technology; ongoing higher education system projects using network technology; and higher education and media technology in the 21st century.

The national context

Traditional universities are reforming in response to rapid change in the social context, while other higher education institutions are challenging universities to enhance the quality of education. Major changes include increased flexibility, improved quality of popular higher education, opening universities to the public, coping with lifelong learning, responding to internationalisation, and developing the individuality of each university. It is against this background that media technology is expected to renovate the organisation, contents and methods of higher education.

This chapter describes current trends on higher education and media technology from the viewpoint of changes in the labour market, education system, and media technology.

Change in the labour market

In Japan it is common for enterprises to employ new graduates immediately on a permanent basis rather than to find the right person for the right job, since Japanese enterprises believe that they are responsible for providing their employees with the necessary vocational capabilities. However, the Japanese social system for vocational education was underdeveloped and poorly regulated.

According to the Labour White Paper of 1994, the proportion of the workforce younger than 29 years decreased from 45 per cent to 32 per cent between 1962-92, meanwhile that of workers older than 50 rose from 11 per cent to 21 per cent. The percentage of workers with long-time service increased from 29 per cent to 42 per cent, and that of new male graduates from 13 per cent to 26 per cent. The proportion of personnel engaged in special and technical work rose from 7 per cent to 12 per cent, and clerical and administrative workers went up from 18 per cent to 24 per cent. These figures reflect an ageing, long service, white-collar oriented labour force, mostly with higher education qualifications.

While 80 per cent of enterprises intend to emphasise sales and marketing and R&D in the future, they also wish to strengthen marketing and technical innovation. The proportion of jobs requiring special knowledge and technology is expected to increase to 53 per cent (the largest group); jobs requiring experienced skill and technique will rise to 50 per cent and jobs requiring broad knowledge and technique will go up to 47 per cent. Under these circumstances, such capabilities as highly developed expertise, broad experience and knowledge are required.

Overall, the proportion of people taking off the job training (OFF-JT) is very high, at 78 per cent. Those in training identify their purpose as:

– "acquisition of fundamental knowledge and skill"	43 per cent (mainly new employees);
– "improvement of special knowledge and skill"	41 per cent.

The main causes of dissatisfaction with vocational training were:

– too few kinds of course	59 per cent;
– unsatisfactory level of contents	49 per cent;
– courses too short or too few sessions	47 per cent;
– too few trainers	45 per cent.

In order to train such employees, various kinds of the technical and vocational education are demanded and will play an important role in lifelong learning in Japan.

Change in education system

The educational system of Japan consists of six years of elementary school, three years of lower-secondary school, three years of upper-secondary school and four years of university. There are also junior colleges with two-year curriculum, and technical colleges with a five-year curriculum for lower-secondary school graduates.

Nine years of elementary school and lower-secondary school are compulsory. However, the percentage of students who continue to upper-secondary school has levelled off at about 94 per cent for both male and female students. The percentage of those continuing on to junior college or university was 41 per cent, and university and college graduates entering post-graduate courses was 8 per cent.

Technical colleges and specialised schools have become the core of the technical and vocational education. The first technical college was founded in 1962 in order to train engineers with advanced practical skills who would be able to meet the demands and challenges presented by Japan's rapid scientific and technological progress. Technical colleges are higher-education institutions which provide five-years of consistent practical education to students who have completed a junior high school course. The curriculum can be modified to suit the students' individual abilities and preference. In 1993, there were a total of 62 technical colleges in Japan, with an entrance capacity of 10 990.

The first special school was founded in 1976 as an institution to provide practical vocational education and training for special skills. The curriculum of special schools is designed to precisely and flexibly meet the various educational needs prescribed by social change. In 1993, about 700 000 students were enrolled in special schools. The freshman class accounted for 16 per cent of students graduating from upper-secondary school that year in Japan.

The rapid ageing of the population and several other changes have made it necessary to afford learning opportunities to citizens at every stage of their lives, and the Ministry of Education is shifting priority in policy from school education to lifelong learning. It is promoting "Refreshing Education" which requires higher educational institutions to offer workers opportunities to attaining and refreshing new types of knowledge and technology in order to cope with rapid technological innovation and changes in industrial structure.

Today various capabilities are needed to foresee dramatic technological changes, to perform effective research and development, and to conduct original, unique and skilful research. A new framework is necessary in higher education based on the long-term vision.

The change in media technology

With social progress towards an information and multimedia society, various types of media technology are coming into active use in higher education. The media available for education can be classified roughly into three types: broadcasting, communication and package media.

Broadcasting media include radio broadcasting (AM, FM), television broadcasting (VHF, UHF), satellites (BS, CS) and Community Antenna Television (CATV). The feature of this type of media is that wide-area service is available but is highly restricted to one-way communication. The switch-over to multichannel broadcasting is being dealt with by applying multiplexing technology, while high-quality intelligent transmission systems including High Definition Television (HDTV) are coming into practical use, through digital technology. There is also some development of two-way communication systems like two-way urban Community Antenna Television (CATV).

As for communication media, the exchange of images has been becoming easy due to the expanded use of Integrated Services Digital Network (ISDN) as an information infrastructure, together with basic technology such as telephone, facsimile and electronic mail. In addition, the range of the use of communication satellites has been increasing, and is put into practical use. Advanced communication networks using optical fibres will cover all of Japan by 2010, and will provide support for the construction of new education systems. Distributing television programmes using such technology as VOD (Video on Demand) began this year.

In package media, the CD-ROM, CD-I, Video CD, and Photo CD environment is being improved and enriched. The recording medium is changing from tape to disk, and the use of package media as educational materials with mass storage capacity and random accessibility is expanding.

The common feature found in the development of media technology is the rapid progress of digital, computer and materials technology, with other technologies being integrated into multimedia technology.

From the educational viewpoint, the rapid progress of media technology has brought these same functions into education. Multimedia is constructing new types of educational concepts such as virtual university, combined with network technology.

Media technologies in higher education

This chapter describes four major systems which use media technology to provide higher education:

- University of the Air;
- Hokkaido Institute of Information Technology;
- University open-lecture programmes via broadcasting;
- Refreshing Education using communication satellites.

These are all successful higher education systems making use of the wide coverage and openness of broadcasting media. Their success is probably due to the fact that broadcasting technology is, at present, the most mature medium in terms of the ability to establish effective educational systems for learners with diverse needs. The common challenge is how to compensate for one-way-communication, the principal weakness of broadcasting media.

The University of the Air provides courses in humanities, social sciences and natural sciences using television and radio broadcasting for various age groups, aiming at their acquisition of higher education and deepened studies of actual life.

Hokkaido Institute of Information Technology (HIIT) provides courses in information and management technology for students in special schools and in the Hokkaido Information University (HIU), to provide them with the practical skills demanded by today's information society.

University open-lecture programmes via broadcasting are delivered to provide lifelong learning of citizens in each region, by making intellectual resources available to the community and universities of the region.

Refresher Education provides courses at the forefront of specialised technical fields for professional engineers via three communication satellites. The purpose is to help engineers acquire updated knowledge and maintain the high level of expertise required in their professions.

Case 1 -- The University of the Air

The purpose and objectives

In response to today's demand for lifelong learning, the University of the Air was founded with the purpose of providing people throughout Japan with an opportunity to pursue higher education using television and radio.

Preparation for its foundation began under the leadership of the Ministry of Education with a request for advice in 1967, followed by ten years of research and study. The university was established in April 1983, with the first class of students enrolled and broadcast lectures started in April 1985.

Faculty, areas of study and majors

The University of the Air consists of the Faculty of Liberal Arts alone. It handles a wide range of study areas, for students hoping to expand their knowledge of specialised subjects. Three areas of study are offered by the faculty (Science in everyday life, Industrial and social studies, Humanities and natural sciences) with a total of six majors (Living and welfare, Human development and education, Social and economic studies, Industry and technology, Humanities, Natural science) (Table 1). Students who wish to graduate must declare one of the six majors, and can take courses offered for other majors. Educational objectives of the majors are:

- Living and welfare: to deepen understanding in life sciences, food, clothing, housing, health, welfare, which are the basis of a cultured life.

- Human development and education: to obtain basic knowledge of child rearing and education of the young, while understanding the role of education in human development.

- Social and economic studies: to obtain a general understanding of political, economic and social systems and their problems.

- Industry and technology: to understand general trends and business management.

- Humanities: a survey of the characteristics of modern civilisation and regional cultures with emphasis on thought, literature and art.

- Natural science: a study of nature from various scientific viewpoints to foster appreciation and understanding of nature, while also obtaining insight into the human-nature interactions.

The courses offered by the majors are both common and specialised. Common courses involve general studies within humanities, social sciences and natural sciences, foreign languages and physical education. In the academic year 1995 there were 319 broadcast courses. Curriculum flexibility is essential -- one quarter of the courses are revised every year, enabling a quick response to contemporary social needs.

Table 1. **Broadcast courses in 1995**

Common courses

Humanities

Introduction to lifology
Structural analysis of living
Problem of education in the world
Psychological principles of education
Outline of psychological research
Behavioural human science
Introduction to philosophy
Inference and analysis
Contemporary views of man and world
Chinese thoughts
Japanese contemporary poetry
Expression and comprehension in Japanese language
Holland and Japan in the Edo period
Human geography
History of daily life
Theory of family life
Education in contemporary society
Educational psychology
History of psychology
Child development and culture
Fundamentals of ethics
Introduction to semiology
Comparative thought
Outlines of Indian philosophy
Outline of Japanese language
Japanese culture
Religions in the world

Social sciences

Introduction to the study of law
Introduction to politics
Introduction to sociology
Social welfare
Industrial management
History of science and technology
Outline of constitutional law
Introduction to economics
History of folk culture
Japanese economy, industry and business
Introduction to accounting

Natural sciences

Differential and integral calculus I
Linear algebra I
Introduction to statistics
History of physics
History of chemical sciences
Human biology
Basic earth science and astronomy
Nature in Japan
Man and history of views on the universe
Concept and mechanisms of human diseases
Differential and integral calculus II
Introduction to probability theory
World of physics
Basic chemistry
Outline of biology
History of biological sciences
Basic earth science and astronomy
Experimental methods in sciences
History of mathematics

Foreign language courses

English I
English II
English III
English IV
English V
English VI
English VII
German I
German II
German III
German IV
French I
French II
French III
French IV
Chinese I
Chinese II
Chinese III
Chinese IV
Russian I
Russian II
Spanish I
Spanish II

Health and physical education

Health and physical education

Physical education

Specialised courses

Living and welfare

Culture and environment
Life course study
Home management
Social demographic issue of population ageing in Japan
Cultural study of clothes
The history and culture of human nourishment
Food for human life
Dwelling in modern Japan
Urban housing
Maternal and child health science 2
Adolescent health science
Health science in senescence
Mental health of today
Health science of bone and joint
History of illness in Japan
Welfare for the disabled
Social security
Life and welfare in ageing society
Social security

Family process
Household economy
Consumer affairs
Clothing life
Clothing comfort
Science and technology of foods
Outline of dwelling
Environmental science for dwelling
Maternal and child health science 1
Health science in puberty
Health science in adulthood
Health science of mental life
Health and human environment
Brain and biological integration
Welfare for the children
Welfare for the elderly
Social welfare
Individual research

Human development and education

Educational anthropology
History of education
Moral education
Scholastic achievement and its problems
Culture of childhood and youth
Higher education
Community and education
Theory media education
Developmental psychology
Cognitive psychology
Personality
Depth psychology and psychotherapy
Child psychology and education
Psychology of ageing
Language and education
Guidance
Psychological measurement
Individual research
Family relationships and personality development in infancy
Developmental of psychology of discourse, comprehension and production

Modern history of educational ideas
Educational sociology
Theory and practice of curriculum
Preschool education
Mechanism of school system
Relations between the family and the school
Lifespan development and continuing learning
Internationalisation of Japanese education
Psychology of learning
Social psychology
Clinical psychology
Counselling
Adolescent psychology and education
Child development and development disorder
Visual disorder and cognition
Educational evaluation
World of child

Social and economic studies

Civil law
Commercial law
Criminal law
Law on international relation
Labour law
Historical and ideological introduction to law
Western political history
Politics of the third world
Politics government in the United States
Western political thought
Contemporary international politics
Local government in contemporary Japan
Finance
Japanese economic history
Economic thought
Sociology of modernity
Mass media today
Culture and society
Sociology of deviance
Transnational relations
Individual research
Family law
Administrative law
The law and procedure
Economic law
Five new fields of contemporary law
Japanese political history
Politics advanced countries
Public administration
Japanese political thought
Modern political analysis
Contemporary Japanese politics and policy
Fiscal policy
International economics
Western economic history
Economic civilisation
Social research
Life and culture in Japan
Sociology of gender
Urban sociology and community
Changing society in Japan

Industry and technology

Business, information and technology
Foundation of productivity science
Exercises in statistics for economics and management
Finance and accounting
Management and development of local areas
Principle and practice production management
Linear programming
Information management
Modern agriculture, forestry and fisheries
Industrial development in South Asia
Environmental assessment
Energy engineering industries and society
Systems engineering
Ergonomics in daily life
Fundamentals of urban planning
Individual research
Production management on Japanese enterprises in Asia
Creativity in business management
Statistics for economics and management
Management accounting
Labour-management relationship
Real estate management
Maintenance management
Industry and information
Management and policy of small scale business
Farm management in Japan
Urban management studies
A modern technology
Information engineering
Introduction engineering
Instrumentation and control engineering
Industry and technology modern society

Humanities

History of Western classical philosophy
Contemporary philosophical situation
Philosophical anthropology
Philosophical inquiry into some aesthetic problems
Japanese medieval literature
Japanese literature in the Modern Ages
The life of Hikaru-Genji
Japanese language and culture II
Japanese philology
Tales and novels in Chinese literature
German literature
Russian literature
Archaeology
History of medieval Japan
History of modern Japan
History of modern China
History of the Mohammedan world
European history II
American history II
History and theory of art
Ethnomusicology
African culture
Museology II
On man
History of Western modern philosophy
Philosophy of science
Comparative religion
Early Japanese literature
Japanese literature in the Edo period
Japanese literature -- its authors and work
The inner world of Tsurezuregusa
Linguistics
Chinese classical poetry
English literature
French literature
World literature of today
History of ancient Japan
History of the Edo period
Asian history IV
Modern and contemporary southeast Asia
History of classical antiquity
American history I
Theory of beauty and arts
History and ideas of music
Cultural anthropology
Museology I
Individual research
Theories and practice of teaching Japanese as a foreign language
Comparative study of the eastern and western theatre

Natural sciences

Differential geometry
Applied mathematics
Scaling methods
Mathematical logic
Calculus through personal computers
Mechanics
Light and electromagnetic field
Introduction to relativity
Material science: solid state physics
Material science: organic chemistry
Bioorganic chemistry
Material science and technical development
Natural science -- study of matter
Plantphysiology
Molecular biology
Evolution and taxonomy of plants and fungi
Cell biology
Natural science -- study of life
Basic astrophysics
Solid earth
Atmosphere and seas
Complex analysis and differential equations
Data and data analysis
Statistical decision theory
Computer mathematics
Introduction to chaos and fractal
Statistical thermodynamics
Quantum mechanics
Contemporary physics
Material science: physical chemistry
Quantum chemistry
Material science: analytical chemistry
Chemical thermodynamics
Chemistry of life
Ecology
Animal evolution
Animal behaviour and animal society
Modern biology
Solar system
Structure and evolution of the universe
Earth science of Japanese islands
Individual research

Students

In principle, anybody who is over the age of 18 is qualified to enter the University of the Air without having to take examinations, regardless of educational background. In general, there are three kinds of students in the University of the Air: regular, one-year non-degree, and one-semester non-degree students. In order to enter the university as a regular student, an applicant must be a high school graduate. Non-degree students study particular subjects according to their interests over one year or one semester (six months), and enrolment is open to anyone over 18. The number of the students enrolled this academic year is approximately 58 000. Of them, 25 763 are regular students, 20 163 are one-year non-degree students, and 10 120 are one-semester non-degree students.

Fourty-five per cent students are male and 55 per cent are female. Their average age is approximately 40 years, but the spread is wide, with 5 per cent teenagers, those in their twenties 29 per cent, thirties 23 per cent, forties 22 per cent, fifties 12 per cent, and sixties and older 9 per cent. This age profile is very different from the rest of Japanese higher education where most students are about 20 years old, and it shows that the University of the Air fills a potential niche as a lifelong education institution. Regarding school background, graduates from higher education institutions such as colleges, technical colleges and universities represent 51 per cent, accounting for more than half, and high school graduates represent 48 per cent.

System of education

One of the distinctive features of the system of education of the University of the Air is that most of the courses are provided in the form of broadcast lecture programmes delivered via television and radio. Broadcast media are familiar to learners and have the advantage of accessibility and easy operation. In the University of the Air, broadcast media are used not only to introduce the pacing and formation of basic concepts into education, but also to deepen the contents of learning, which printed study materials cannot satisfy. However, the broadcast media of the University of the Air are limited to the vicinity of the Kanto Plain, which is a hindrance to wide-area use of broadcast media. Almost all broadcast lectures are pre-recorded and no live lectures are given.

The University of the Air distributes lectures from university-owned television and radio stations for 18 hours every day. The course programmes are broadcast from the Tokyo Tower located in central Tokyo over the UHF television system and FM radio. In some regions, the broadcasts received from the Tokyo Tower are relayed from a local transmission station.

The University of the Air adopts a two-semester system, from April to September and from October to March. Entrance is admitted in April and October every academic year. Almost all courses are transmitted either by television or radio as a weekly series of 45-minute lectures, completed in 15 weeks. Printed study materials, mainly textbooks, written by the course lecturers, are provided for all the broadcast courses. Instruction by correspondence is given after the 8th broadcast lecture, and a credit certification examination is given at the end.

Face-to-face instruction is provided at nine study centres. About 100 courses are available during each semester. In order to graduate from a traditional correspondence university in Japan, students are required to take 30 credits through schooling sessions, but in the University of the Air only 20 credits for face-to-face instruction are required.

Roles of teaching staff

Courses are managed by individual teaching staff, rather than by teams, and the roles of the teaching staff are similar to those of professors in traditional universities. A professor makes the lecture plan, decides the contents of the lecture, collects teaching materials, produces broadcast lecture programmes, gives instruction by correspondence, creates an examination, and evaluates students. They are different from teaching staff of traditional universities in that they must produce broadcast lecture programmes. In doing so, the professor and the programme director discuss all aspects of programme production, including visualisation of the lecture programmes, selection of filming sites, and production of graphics. Broadcast lecture programmes are recorded mainly in the studio. Pre-recorded lecture programmes are used for four years in principle.

Budget

The University of the Air depends largely on government financing. The budget of the University of the Air in this fiscal year is approximately $116 million, of which tuition and admission fees account for 22 per cent and grants by the government account for 75 per cent.

Challenges

While the University of the Air has succeeded in filling a unique role as a higher and lifelong education institution making positive use of broadcast media, many challenges remain: to expand broadcasting reach nationwide, to provide higher and more specialised types of education equivalent to graduate school level, to respond to the needs of a multimedia society, and to promote two-way communication. To expand broadcast reach, the University of the Air is working to construct an educational network system using a broadcast satellite, and a feasibility study is in progress in co-operation with other organisations.

Case 2 -- Hokkaido Institute of Information Technology (HIIT)

The purpose of HIIT's foundation

HIIT was founded as a third sector research and development research park created with capital investment by Ebetsu City in Hokkaido and a number of private enterprises in March 1990. It was the third telecommunication research park in Japan to be approved under the temporary measure act for the establishment of specific facilities by private enterprises.

HIIT is a research and development facility in the use of communication networks. It runs information transmitting stations on earth, undertakes research and development on advanced communication technology using multimedia, and research and development of satellite communication technology.

The system of education

HIIT aims to establish, via communication satellite, a nationwide educational system which attaches importance to each individual's ability, and with every individual having the maximum opportunity to achieve favourable educational results. At the same time, HIIT operates a remote educational system using multimedia through which lecturers and students can communicate with one another, and provides an individual learning environment which enables after class review via Computer-Assisted Instruction (CAI). CAI is used for a range of purposes, including the administration of examinations and return of answers to students.

The HIIT's satellite communication-educational system consists of communication satellites, ISDN and computers.

The satellite system involves sending live lectures from the studio to a communication satellite at an altitude of 36 000 kilometres for relaying to sites all over Japan. The system delivers high quality images and sounds to students and to control data within computers installed in classrooms at the receiving sites.

ISDN can be handled as easily as a telephone and can transmit image and computer data at high speed. ISDN is also used to analyse responses, transmit questions and answers between lecturers and students, and transmit classroom pictures enabling students to grasp the situation.

Computers are installed for a lecturer, for classrooms, and for students. The lecturer's system provides two-way connection and can be operated easily by hand via keyboard and mouse. The information sent by the lecturer is delivered to each receiving site via communication satellite. Computers for classrooms analyse computer data from satellite and execute procedures for two-way communication. They also present educational materials to the monitors of students' computers. Each student is allocated a computer in the classroom which is used for displaying the lecturer's visual and teaching aids, for communicating with the lecturer, for individual study using CAI, as well as for opinion exchange among students and between the student and the lecturer.

HIIT satellite communication system leases and uses a Super Birdtransponder, one of the business communication satellites, from 8.30 to 18.00 daily. Using the transponder, it is possible to send two perfect moving video pictures simultaneously. Using this feature, HIIT delivers lectures on higher education in the morning for students in 19 special schools all over the country and in the afternoon for students in HIU. Satellite lecture programmes for students in special schools started in April 1992 and those for students in HIU in April 1994.

Tasks for the future

HIIT delivers lectures nearly every day for three hours in the morning and for three hours in the afternoon through two channels, using a communication satellite. The number of students using this system in special schools is in the range 2 000-3 000, in addition to approximately 200 in universities, but these numbers are too low to justify the service. According to interviews with those concerned, although expenditure exceeds income at present, a 30 per cent increase in the number of students would resolve finances. However, lecture programmes via communication satellite have just started and an increase in the number of students using this system is anticipated in the near future.

Lecture programmes for special school students

Those using these lecture programmes are students in 19 special schools and colleges of information and management technology located all over Japan. Anyone with a high school qualification or higher is eligible to enter these professional colleges, and most of the students are in their late teens to early twenties. Face-to-face classes account for 80 per cent of the courses and communication satellite lectures for the remaining 20 per cent. Although each professional college's curriculum is different, courses on information and management are provided. Lecture programmes available to special school students via satellite communication include: Introduction to computer technology, Software, Hardware, Operating systems, Telecommunication networks, Local area network, Bookkeeping, System development, Programme development, Communication technology, Human interface, Databases, Multimedia, Algorithms and data structure, Problem solving method.

Hokkaido Information University (HIU)

While the University of the Air has established the Faculty of Liberal Arts to provide lifelong learning at college level to various age groups of learners, HIU has established the Faculty of Management Information to train those in key roles in the information society. The Faculty of Management Information comprises the Management Department and the Information Department. The Management Department trains future administrators to use management information, while the Information Department trains engineers. HIU has also established correspondence courses, making use of HIIT's educational satellite system. The teaching and leaning system used for the correspondence courses is generally similar to that of the University of the Air but, while students of the University of the Air take broadcast lectures at home, those in HIU take communication satellite lectures in 16 study centres located all over Japan. Teaching assistants maintain the lecture environment in the learning centre classrooms and assist class proceedings. Satellite communication courses offered by HIU include: Programming languages, Information science, Computer theory, Computer operation, Artificial intelligence, Software technology, Operating systems, Application systems, Image processing systems, Operational research, Audio technology, Management theory, Economic measures, Accounting, Bookkeeping, Regional economics, History, English and Statistics. HIU intends to establish new faculties in the future, such as the Faculty of Space Information and the Faculty of Bio-information.

Case 3 -- University open lecture programmes via broadcasting

University open-lecture programmes aim to promote lifelong learning by sharing universities' intellectual resources with the regional community through the broadcasting media, as well as to improve pedagogy at universities through research and development of the content of university education and teaching methods via broadcasting.

Since the National Institute of Multimedia Education (NIME) was founded in 1978, universities, under its leadership, have produced and broadcast lecture programmes in co-operation with commercial broadcast stations in individual communities. The themes of the lecture programmes have been chosen in the light of the characteristics of each university and the needs of the local community.

The learning system comprises broadcast lectures, textbooks, and classroom sessions. Learners read the textbook and watch broadcast lectures. Each course includes thirteen 30-minute broadcast lectures. Classroom sessions are given two to four times per course to enrich the broadcast based study and to exchange ideas on learning among learners and lecturers.

Nine blocs of universities throughout country provide university open lecture courses, with each determining the themes, producing lecture programmes and textbooks, setting up classroom sessions, advertising, and deciding admission. Every year, one or a few universities are chosen within each bloc to be in charge of television and radio programmes, and lecture programmes are produced centring on these universities. The programmes are broadcast within the bloc, and schooling sessions are conducted afterward in co-operation with other universities in the bloc.

54 of the 553 universities in Japan have participated in university open-lecture programmes via broadcasting. Table 2 shows 23 courses which were taught in 1994.

Table 2. **Course broadcast in 1994**

Sex and life -- men and women in animals (Hokkaido University) -- TV (T)
Children's scenes (Hokkaido University) -- Radio (R)

Education in the days of restructuring (Tohoku University) -- T
Messages from the "end" -- near the "fin de siècle" -- R

Politics in Japan today -- system, management and problems (Niigata University) -- T
Epic poem of medieval Japan -- R

Japan sea region -- science and civilisation of water (Kanazawa University) -- T
China, in the policy of the open economy -- R

A 400 million years history of Shinshu, Japan (Shinshu University) -- T
Health care as general culture -- R

Living and materials for 21st century (Nagoya University) -- T
Law and politics in modern Japan -- R

Bringing the world together (Osaka University) -- T
Human science of fluctuation -- R

Science of traffic safety (Hiroshima University) -- T
Man and music -- R

To have healthy old age, second series (Kochi Medical University) -- T
Living environment and health -- R

Its nature and people (Kumamoto University) -- T
Children and youngsters of today in Japan -- their various characteristics -- R

Advanced medicine -- the present and future in Okinawa (University of the Ryukyus) -- T
Development through life -- malleability in human -- R

The world of art and crafts: an easy-to-learn introduction to basic techniques (Takaoka University) -- T

Case 4 -- Refresher Education using communication satellites

Refresher Education provides updating education in occupational skills, to individuals engaged in those occupations, through formal higher educational institutions such as universities, technical colleges and junior colleges. An experiment has been conducted to conduct Refresher Education using communication satellites.

The results of a Ministry of Education survey on the need for Refresher Education, identified a great need for basic engineering courses (in college level), professional courses (in graduate school level) and advanced technology courses. Demand was particularly great for programming (software), measurement/control, management/administration and machining. In advanced technology, the needs for electrical/electronic communication, information (hardware), information (software) and management were prominent.

Based on these results, a programme of lecture meetings about science and technology was conducted in 1992. In 1993, the programme was on advanced technology, and in 1994, on information engineering and computational engineering. The following are the subjects of lectures of each course programme:

- The 1st Programme, November 5, 1992: "The effect of opto-electronics on society", and "What the new age will expect of engineers".
- The 2nd Programme, January 19, 1993 (Lectures by a Nobel Prize winner): "The ideal way of research and development: difference in ways of thinking in research work between the United States and Japan", and "Creation: aiming at the 21st century".
- The 3rd Programme, December 1-3, 1993: "Micro machine", "Micro machine and new robotics", "Virtual reality and tele-existence", "Advanced material and its reliability", "Evaluation of materials", "Intelligent materials science", "Superconducting electronics", "Semiconductor device and quantum mechanics", "Artificial organ and micro machine", "Organism and oxygen", "Flight and the way of swimming of living beings", "Biotechnology", "Technology and society", "Urban environment and metabolism", and "Intelligent information technology and human being".
- The 4th Programme, December 13-14, 1994: "Invitation to the most advanced computer graphics", "The environment for the development of next-generation software", "Learning computer", "Invitation to computational linguistics", "Very high speed asynchronous computers", and "Information security technology and its role".

Six national universities and about 350 enterprises with receiving equipment were connected with NIME making use of three communications satellites, and real-time lectures were given to engineers. The contents of lectures and the quality of the sounds and images were highly rated.

The number of participants enrolled in Refresher Education programmes via communication satellites were approximately 4 000 for the first programme, 2 000 for the second, 2 700 for the third, and 2 000 for the forth. 93 per cent of participants were male with ages evenly distributed from the twenties to sixties. 32 per cent of the participants were engaged in education and staff development, 30 per cent were technicians, 18 per cent students, 10 per cent technical researchers, and 6 per cent managers. Participants experience ranged evenly from the less-experienced to those with 20 or more years experience.

Technical systems for Refresher Education generally met with favourable reviews and no practical hardware problems exist, but it is important to continue to improve the software system, research, curriculum development, and lecturer acquisition, in order to keep providing lecture programmes appropriate to the needs of working members of society.

Case 5 -- Network technologies in higher education

Much research and development on the use of new media technology for higher education is currently being conducted in Japan. Spurred by recent rapid progress in media technology, large projects are underway making use of communication networks with a large capacity to transmit information for education. This section introduces ongoing higher education system projects which use the latest media technology.

SCS (Space Collaboration System) Project

The purpose of the SCS project is to construct an inter-university VSAT network to be used mainly for video exchange among national universities throughout Japan, and to establish a wide-area multi-site educational system suitable for discussion and debate type classes. This project was planned under the leadership of the Ministry of Education after learning the outcome of experiments in the educational use of communication satellites by the National Institute of Multimedia Education (NIME).

In the SCS, NIME functions as a hub station of VSATs installed in universities. The elements of this system are: 1.5 Mbps picture/data exchange, controlled VSAT by a hub station and easy switching among multiple sites, with no qualified staff in university VSAT station.

The use of communication satellites has many advantages. They can cover a whole area of the country, offer information nationwide simultaneously, and are interactive, which is an important feature for learning. In addition, VSAT systems are effective in terms of the cost and spectrum efficiency owing to the compactness and the use of compressed video system. Images are exchanged at a rate of 1.5 Mbps among multiple universities by the mutual use of two channels. Although the quality of the exchanged images is slightly inferior to that of television images, it presents no problems when sending still-frame images or conducting discussions. The system's distinguishing feature is its easy-to-use satellite link: while the Radio Law requires that a qualified radio engineer be employed to operate each earth station, there is no such requirement for the VSAT stations.

Making effective use of these VSAT advantages for higher education, the SCS project aims to promote new diversified types of education and research exchanges, such as mutual lectures, joint seminars and workshops. Through these activities, this project promotes research and development of new styles of educational systems as well as teaching methods and contents, using various forms of data such as image, sound and text-based information.

The project began in 1995. This year saw the establishment of the hub station at NIME, and 50 VSAT stations are preparing to develop the Space Collaboration System.

Asynchronous Transfer Mode (ATM) Network Project

With the development of multimedia technology, there are plans to construct a high speed network which would transmit information comprehensively, from small-capacity, low-speed information such as text-based data, to large-capacity, high-speed information such as HDTV images and sound, using fibre optic and communication satellite channels.

This project started in 1994 with research and development of the educational use of ATM networks, adapting recent progress in B-ISDN research and development.

NIME and ten higher educational institutions have collaborated to construct an ATM network supported by Nippon Telegraph and Telephone Corporation (NTT). The network's data transmission speeds of HDTV data are from 10 to 156 Mbps, NTSC standard data can be transmitted at a maximum speed of 12 Mbps.

This ATM network has more transmission capacity than do the 64 Kbps networks which have recently become pervasive. Therefore, the new network implements a more natural environment for higher education, overcoming time and space-related constraints. It will change conventional classes, where all students have to assemble in one place at the same time, into a more flexible and diversified style of education. It will contribute to distant and broad area redistribution of intellectual resources and expand the social function of higher education institutions as well. The high capacity network substantiates the feasibility of a two-way interactive learning environment, which tends to be insufficient for meeting the practical requirements of education. Moreover, the ATM network is expected to increase the efficiency of researchers' activities.

On-line university project

The purpose of the on-line university project is to realise a virtual university using the Internet. This project uses super high-speed communication networks for research and development of the communication technology field, such as on-demand two-way classes, multimedia information space, and large-scale computer environment.

Sixteen universities have participated in this project. Mutual lecture exchanges are due to begin next spring on an experimental basis, using a 2.4 Gbps network provided free of charge by NTT. These experiments will be conducted with students on campus using communication terminals at each university. In the future, they aim towards classes using communication terminals at home. In order to realise a virtual university, there are several tasks which must be carried out, namely the establishment of communication networks and educational systems which accept such lectures as credits. When the virtual university is completed, working members of society will be able to participate in higher education easily, and this is expected to contribute greatly to university extension.

Higher education and media technology in the 21st century

The remarkable development of media technology and the expansion of its function will stimulate the reform of universities in terms of organisation, content and teaching methods. People will demand not only the improvement of traditional higher education, but the development of a new higher education model through the effective use of media technology.

Higher educational institutions in the 21st century will fall into the following three types, from the media technology viewpoint: traditional universities, universities which will make full use of media technology, and universities of a future type.

Traditional universities will use the media at a minimal level retaining their traditional style. However, the use of media technology in campus work will become much more frequent. The characteristics of this type of universities are giving lectures on campus, using media on campus, and exchanging information through a network on campus.

Universities which will fully utilise media technology are those which will more actively use communication networks. It will be possible to receive not only lectures in the classroom but also off-campus through networks. The main characteristic of this type of university is active openness to the public in order to best use the media, through lectures on campus, classes open to the public, and lectures open to the public through communication networks. Many Japanese universities will adopt this type.

Universities of a future type are virtual universities, which will not have physical campuses. All the functions of the university will be realised through the network. Teaching staff will give lectures through the network and students will access them according to their own needs. The characteristic of this type of university is the virtual campus, where teaching staff and students who can give or receive lectures while at home or elsewhere. The classrooms and campuses are realised in the virtual space. This will, of course, pose many technical and systemic problems, but it is certainly possible that such institutions will have a noticeable effect on the education of full-fledged members of society and an important position in higher education in the 21st century.

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KOREA -- MULTIMEDIA IN COMPANY TRAINING

by
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The national context

In May 1995, the Presidential Education Reform Committee announced the Korean Education Reform Plan, to develop a new educational system for the information society. The plan will enable everyone to have educational products and services whenever and wherever they need them. The background philosophy is to provide all people open and lifelong education. To prepare for the "information society", people must be able to analyse real world problems and develop creative and analytical thinking skills. Students must think more globally and creatively, be able to handle more complex information with new information technology, and understand and co-operate with different cultures.

These skills are, however, very different from knowledge and skills learned in schools today. The current educational system in Korea provides students with knowledge, skills and techniques in a very rigid form, and focuses on passing the entrance examination of colleges or universities. The quality of higher education is consequently low. Facilities are insufficient and obsolete. Investment in adult education is generally scarce and inadequate to cope with social change and industrial needs. Although it is believed that the only and most efficient path to development is to cultivate able and creative human resources, the adult learning system for retraining is not efficient and opportunities are insufficient.

In this context, the committee proposed the New Educational System to support equal opportunities, to use new information technologies to promote learning possibilities, and to deliver the appropriate materials. In the Education Reform Plan, various action plans for adult education development are proposed. The objectives of these action plans are to build up the new lifelong learning society and to readapt workers to the changes of new knowledge and technology in their field, and in industrial and labour market structures.

Many of these action plans are based on new information technologies, and especially on computers and information communication systems. For example, the AEEP (Adult Enrichment Education Programme) will be conducted through computer network communication, cable television, satellite, and video conferencing systems. According to the plan, those wishing to learn can access and use needed multimedia educational software and resources, at any place and time, and these materials will be developed through government support. To retrain workers, a new type of college is to be founded, which will be a kind of open university for workers and potential workers, and will educate mainly via new information technologies.

Using information technology in adult education

New information technologies are used in a variety of ways in the field of adult education in Korea. Examples can be found in various settings, including universities, post-graduate training programmes, continuing education sectors, and company training. Some universities have begun providing new types of college courses through personal computer communication systems, with teachers delivering their lectures through the Bulletin Board Service (BBS) of their university's computer network system or a commercial personal computer communication system. Students can discuss or send their reports to professors via personal computers to their home or other systems.

Some other universities use computers as a presentation tools or an instructional medium for lectures. In this case, lecturers and students demonstrate or present materials or research output via personal computer and beam projectors. On the other hand, professors use computer-assisted instructional programmes to help students better understand difficult or abstract texts. Videoconferencing systems are also used for adult education or training in some universities and companies. For example, one company offers an MBA (Masters of Business Administration) course for employees retraining with Michigan University in the United States through a video conferencing system and the Internet.

Korean case for this study

The Korean case adapted for this study is an adult-learning programme using a multimedia-based training system. In the past, Korean companies have been more concerned with production than with human resource development (HRD), but this is now changing, especially in big enterprises, which are increasing their investment in HRD. The demands of new skills along with economic growth require increased planned training, to enhance specific learning skills and to promote company culture. This is in the context of the present study of a large Korean company carrying out multimedia CD-ROM-based training for nationwide and regional-specific programmes.

Case Study -- The Samsung Global Management Institute

Samsung needs individuals who are fluent in local languages and who understand local customs and etiquette well enough to work comfortably with the people. They must also be specialists who can effectively carry out their duties in the global marketplace, as well as be able to use information competitively and adapt quickly to change. The SGMI cultivates and trains personnel for international work, and specialists for specific countries or geographical regions, while also providing a centre for gathering information from around the world and disseminating it world-wide. SGMI offers a wide range of training programmes to promote employee confidence in the globalisation process, through training in foreign languages, cross-cultural adaptability and other fundamentals needed for internationalisation, while training for specific job skills and individual countries and regions prepares specialists for international business.

Curriculum of the institute

SGMI curricula are specialised and systematically organised, covering the basics for internationalisation as well as courses on specific job skills and individual countries or regions. They include:

- Basic and personal skills and character training

Foreign language and cross-cultural adaptability programmes are offered for international staff. Courses cover international awareness, international negotiation skills and cross-cultural management.

- Job skills for international business people

Courses aimed to prepare specialists to conduct business effectively in specific markets. These courses cover subjects such as overseas marketing, international finance and law, managing offshore offices or plants, regional economic blocs, and overseas investment.

- Country and region-specific training

SGMI offers courses which focus on particular countries or geographical regions. They include local politics, economy, culture, business practices, recent trends, analyses of the overall business environment and ways to start up new businesses.

Needs analysis for the CD-ROM titles

Needs analysis and decision-making process

The programme was shaped by the needs of personnel management. In March 1994, SGMI was not part of Samsung's main group, but rather under the Task Force organisation of the educational department of personnel management section of the Samsung Trading Company. The trading company saw a need for a programme to prepare for its incorporation into the Samsung Trading Company.

In November 1994, SGMI developed a regional-training programme series geared towards this "internalisation". A total three persons from the company were involved in this project, including two staff members and one secretary transferred from the sales department of the Samsung Trading Company to the training department as Task Force personnel -- none of whom have a background in education or training. Three individuals were identified as "decision-makers": a development initiator for practical working staff, head of training department for practical decision-making, and head of personnel management for formal final decision-making.

Decision-making process

Everyone agreed on the need for a programme, but not everyone was confident about the likely results, and while people supported the idea of programme development, they were either neutral or against the project. One cause of discontent was the high cost. At the time, the Instructional Systems Development (ISD) model was newly introduced and training courses were developed using this model spending $10 000 per course. An additional $45 000 development fee for the CD-ROM programme was unpopular despite its likely effectiveness.

Another more significant reason was doubt as to its likely educational effectiveness. The evaluation of its likely effectiveness did not even satisfy the development team. The final decision was made after the training and development team visited the United States to examine Computer-based Training (CBT) development and a related academic field. The third reason for discontent was the lack of course development experience in the training team and the limited time for decision-making. It also took a long time to move from the planning budget to actually producing the programme -- it was an early stage of industry and academy co-operation. The rationale for using technology is threefold -- effectiveness of learning, management, and ultimately cost-effectiveness.

Analysis of learners

The targeted learners for the programme were employees whose work related to China, for example, businessmen working as regional-specialists residing in different Chinese regions. Since the learners for this CD-ROM title were volunteers -- including businessmen, technicians and researchers -- they were quite self-motivated. The background of learners varied in types of job, experience, year employed, and age. For this study, trainees for observation were selected among a group of 15 who were registered for the 2nd Regional Training for China programme.

Content analysis

The programme is based on the information required by professional businessmen specialising in business, investment, and negotiation in China. The main contents consist of two parts: problems arising when carrying out business and investment tasks; and the Chinese approaches to trading, commercial habits, consciousness, culture, politics, and economy. The educational aim of the CD-ROM programme is to promote working skills by understanding the characteristics of China, to cultivate professional businessmen in Chinese by learning the dynamics of Chinese society, history, politics, and culture, and to maximise adaptability to residence in China.

Development process

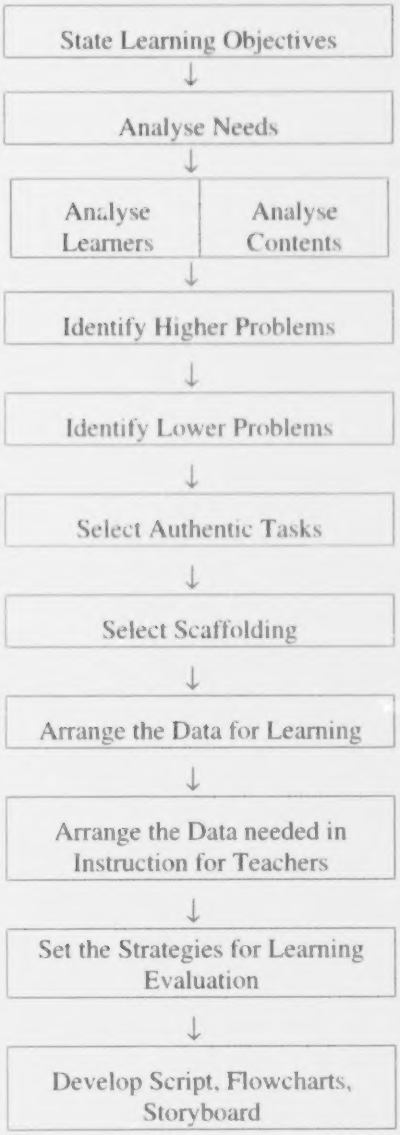
The development team was composed of a regional study team leader, a consultant as project development manager, and three instructional designers.

Instructional design

The principle of instructional design for the programme is constructivism, situated learning and anchored instruction. This design theory enables students to learn by transferring knowledge and skills to real world situations by practising various tasks in situated learning; by acquiring inferential reasoning and metacognitive skills applicable to problem solving situations; having cognitive apprenticeship in the training setting; and having opportunities to practice in real situations. Figure 1 presents the instructional design model for the CD-ROM title development based on the above theories.

The design principle also allows the designer to modify instructional materials and strategies as needed after the development phase is completed.

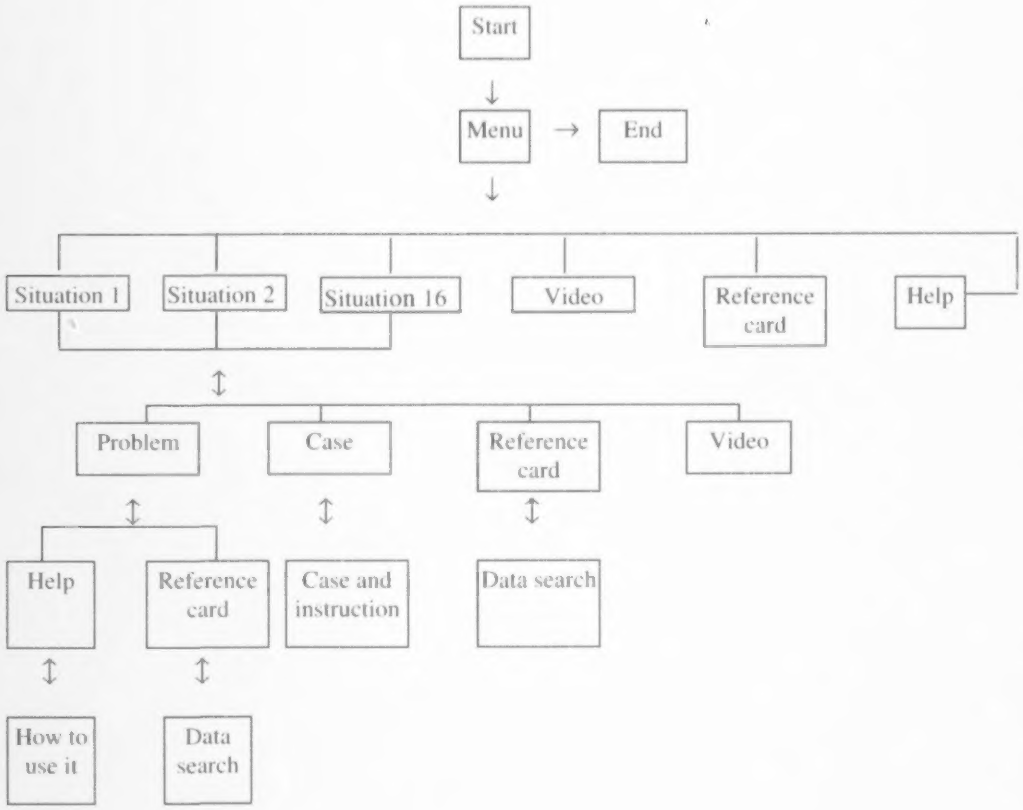
Figure 1. **Instructional design model for CD-ROM title**


State Learning Objectives
Analyse Needs
Analyse Learners
Analyse Contents
Identify Higher Problems
Identify Lower Problems
Select Authentic Tasks
Select Scaffolding
Arrange the Data for Learning
Arrange the Data needed in Instruction for Teachers
Set the Strategies for Learning Evaluation
Develop Script, Flowcharts, Storyboard

Development materials

The CD-ROM title was developed using the Authorware Professional authoring system. Video material and a printed workbook for reference cards were developed. The CD-ROM title presents a scenario which describes the current status of business and investment in China in 16 parts. Each part consists of (1) video materials which provide motivational and realistic situation, (2) problems, cases and hints which can be used as scaffolding, and (3) reference cards which provide specific information. Based on self-regulated learning, the CD-ROM title seeks to prepare learners to construct their own strategies for problem solving in real situations, to identify the causes of problems, and to search essential knowledge repeatedly at any time through reference cards. This is supplemented in advanced courses through group discussions, special seminars, and instruction through videotape recorders, and use of data related to China. Figure 2 is the flowchart of the CD-ROM title for China.

Figure 2. **Flowchart of CD-ROM title**


Start
Menu
End
Situation 1
Situation 2
Situation 16
Video
Reference card
Help
Problem
Case
Reference card
Video
Help
Reference card
Case and instruction
Data search
How to use it
Data search

Cost

Budget

The first stage of development was for teachers to produce printed training materials. To develop this text-based material, US$10 000 were spent, with an associated US$8 750 for subject-matter experts meetings, workshops, and purchase of materials, giving a total cost of US$18 750 for one course.

The second stage was to create CD-ROM titles developed by a professor and students of the Educational Technology Department of Ewha Woman's University. Authoring the CD-ROM title costs US$ 22 500, with US$ 15 000 for the video production. Including the US$ 18 750 for the first stage, the total budget to develop one course programme using CD-ROM was US$ 56 250.

Labour

Two people were used for five months on planning, co-ordinating, and management. Twenty members of staff participated in developing printed training materials, at an average of three days each.

Implementation of the programme

Training hours and schedule

The training was scheduled for four or five days. The first training programme took four days. Morning sessions (2-3 hours) were spent using the CD-ROM, with afternoon sessions (3-4 hours) dedicated to special lectures by professionals (Table 1).

Table 1. **Schedule for CD-ROM based training**

	1st day	**2nd day**	**3rd day**	**4th day**
morning session	orientation and programme demo	CD-ROM (2.5 hrs)	CD-ROM (3hrs)	CD ROM (1.5 hrs)
afternoon session	lecture on Chinese culture	lecture on Chinese regions and business	lecture on Chinese politics	lecture on investment and business
evening	workshop task			

Training environment

The classroom for the Regional Education Programme is located in the main building of the Samsung Global Management Institute. The room is provided with multimedia PCs with a large-screen television linked to a computer net so that each trainee can work individually. This room was used throughout the whole training programme.

Procedures of training application

During CD-ROM sessions, though no assistance or interference was allowed, a training manager attended from time to time for assistance. There was no planned training on how to use the CD-ROM programme before actual lectures, though learners were free to run the CD-ROM programme themselves. The teachers did not have to incorporate the CD-ROM programme into lectures, or preview this new technology-based system. The training manager tested the computer system before the training. Using technology did not modify the traditional relationship of learner and teacher during afternoon lecture sessions.

Methods and results

Methodology for evaluation

Learners were tested during orientation in the first session of the first day to measure prerequisite knowledge, and were tested again after the lecture on Chinese politics on the last day to measure their post-training comprehension. In order to observe learning processes, such as information searching and problem-solving during the training, the think-aloud method was used after each CD-ROM learning session.

Areas of evaluation

- Effectiveness of learning by CD-ROM

The CD-ROM-based programme can overcome differences in learners' previous skills and experiences, and can avoid the risks arising from variation between teachers. Since the Regional Training Programme emphasises information transfer rather than knowledge itself, new delivery systems such as CD-ROM-based programme are needed to process information data as much as possible.

- Effectiveness for training management

Self learning with the CD-ROM replaced about two thirds of student lecture hours, and about half of staff lecture hours. The total reduction in staff costs reached US$ 4 700 for five days of courses. Above all, the quality of training course management and support to trainees was improved. The programme reduces training managers' workload, allowing them to arrange schedules and negotiate with regional specialists in culture, custom, and politics. The programme is relatively unaffected by educational settings, schedules, and numbers of trainees.

Conclusion and suggestions

Conclusion

Regional studies are characterised by the information database more than by specific skills, and can be planned exclusively for learning individually through CD-ROM, or using CD-ROM as prerequisite learning before traditional forms of learning through seminars or training. Multimedia CD-ROM titles can be developed and used as individually-based instruction. The cost-effectiveness of the CD-ROM programme must be considered in the long term and in order to accomplish the needs of the CD-ROM programme, a programme development infrastructure is needed to provide design and development expertise and authoring skills for multimedia programme developments.

Suggestions for future direction

Adult learners are often reluctant to deal with new technology. The older they are, the more difficult they find it to adjust, while younger learners easily. However, once people are exposed to new technology, they tend to become comfortable with it relatively fast. Learners should be given enough time to accustom themselves to new technology, and motivational strategies should be carefully planned.

The roles of lecturer and learner are no longer based on one-way communication from teacher to students. Since students can acquire knowledge or skills from new technology-based materials prior to regular courses, their readiness to learn is quite different from others coming to training without such experience. Teachers must therefore play a different role, as a guide to the environment of new technology systems.

In the future, it is obvious that technology will be used more in adult education. The results of the case study show that trainees can receive both general and specific information using technology-based materials in the self-regulated learning mode. Trainees should use CD-ROM as much as possible before coming to regular training courses. It is also suggested that they use CD-ROM through the network. Employees can enrol in intensive courses after using a CD-ROM title, and exchange their own experience in the course.

The lecture can then focus on more specific problems in response to trainees' needs, and learning can be more authentic and motivated. Trainees do not have to rely on one-way, often unreliable lectures during training. This approach is cost-effective in reducing trainee and managers time, and saving costs for the use of facilities. Employees are not obliged to leave work and go to a remote training centre, and programme co-ordinators are not required to prepare lectures for each training course.

NETHERLANDS -- NETWORKS AND MATERIALS

by
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The national context

Until quite recently, the field of education in the Netherlands was a relatively tranquil one. Various changes, however, have brought an end to what was once a fairly well-organised situation. On the one hand, education has expanded and become a long-term process (it now encompasses adult education and lifelong learning). On the other, education has had to respond to changing ideas about what its pedagogical/didactic and social objectives should be. That has led to problems not only in the primary educational process (*i.e.* teaching), but also in the secondary (counselling and advising students) and tertiary (administration and educational planning) processes.

The solution to such problems has often been sought in information technology (IT). IT has made tremendous inroads in the administrative and planning aspects of education, almost all of which have been "computerised". However, although IT has had a huge impact on these support processes, it has made almost no lasting impression on the primary educational process. Educational institutions generally have the necessary hardware, but they tend to use IT as a mere "aid" in assisting current or future professional practice. Despite the government's efforts, little use is being made of IT as an effective educational tool. Where that does happen, IT serves primarily to replace existing functions (*substitution*). Only scant use is made of advanced, multimedia applications, and it is largely the bigger institutions which are employing information technology to computerise their testing facilities. In short: real change (*innovation*) is rare.

Dutch policy on information technology: a brief history

The Dutch government's role in introducing information technology in education has evolved over the course of three distinct phases: a pioneering phase (to 1984), a stimulation phase (1984-1988) and an expansion phase (1988-1992) (Van Deursen and Moonen, 1991).

During the *pioneering phase*, the policy on information technology was in its infancy and was still largely being prepared. The most important aims were to learn *about* IT and the way computers might be used for organisational purposes. Learning *by using* a computer (computer-aided education) was not considered a priority.

The focus during the *stimulation phase* was on the INSP (Informatics Stimulation Plan). The aim of the INSP was "(a) to familiarise the population with information technology, (b) to create 'human capital' which will assist in bolstering the market sector and in allowing non-governmental facilities to function more efficiently and effectively".

During the *expansion phase*, the aim of the OPSTAP (Operational Plan for Stimulating Activities and Procedures) project was to make the skills promoted through the INSP more widely accessible and to encourage greater use of them in education. A second aim was to stimulate far-reaching educational changes with respect to new information technology. One of the most important requirements was that the field of education should become more autonomous.

The PRINT-VE project (Introduction of New Technology-Adult Education) was launched to achieve this aim in the field of adult education. The policy behind PRINT-VE was twofold: on the one hand, the strategy was to encourage the widespread adoption and acceptance of new technology in adult education, primarily by providing advice and information and encouraging expertise; such encouragement was to be as school-specific and as modular as possible. On the other, the project was to focus on implementing and revitalising education.

The New Media Policy 1987-1991 encouraged the use of "new media", *i.e.* various combinations of information technology, audio-visual media and telecommunications. Some examples are two-way cable, videotext, the laser disk and the interactive CD. The policy focused on exploring and expanding the knowledge of this field. Various small-scale projects and studies were initiated within primary and secondary education and in teaching-training programmes. New media were employed in the teaching process, in direct contact with pupils and students.

Policy since 1992

Briefly summarised, the following three trends emerged:

- the policy themes moved from "learning about information technology" to "making use of information technology in the educational setting";
- the process of introducing IT moved from being centrally stimulated to a deliberate increase in institutional autonomy;
- a conscious effort was made to increase the basis of support for renewal (Van Deursen and Moonen, 1991).

The policy document entitled *Enter: de toekomst* (Enter: the future) was a landmark for post-1992 policy. It set out the main lines of policy with respect to the use of information technology in education for the post-1992 period. These can be summarised as follows:

- the school is the key factor: autonomy and self-determination;
- the period of catching up is over; schools now have a proper foundation in terms of equipment, programmes and expertise;
- information technology is no longer a separate policy theme, but should be linked to other key policy themes;

- the selective role of the government: policy should concentrate on those aspects which go beyond the responsibility of individual schools.

With respect to the policy on adult education, it should be noted that after the reorganisation of the Dutch educational system and the various educational sectors, adult education and (secondary) vocational education have been more or less merged. An attempt is being made to achieve economies of scale and content-specific renewal by setting up Regional Training Centres (comparable to Community Colleges in the United States). Consequently, both of these sectors of education now reside under a single department within the Ministry of Education.

The government's present policy with respect to adult and vocational education focuses on achieving an infrastructure which will allow the use of telematics in education. One of the exponents of this policy is BVEnet Project Management, which was launched in 1994. The BVEnet is a public-sector model project, part of the national action programme "Electronic superhighway -- from metaphor to action". The BVEnet aims to become a knowledge network for the vocational and adult education sector (in Dutch abbreviated to BVE for **B**eroeps en **V**olwassen**e**ducatie), whose main purpose will be to allow this sector to respond more effectively and rapidly to present and future changes generated by the knowledge economy and information society. The BVEnet can be considered an electronic information and communication system which works according to the principles of Internet. It can be accessed by anyone who has the proper infrastructure. By using the BVEnet, institutions (vocational schools, institutions for adult education and the national trade sector bodies) will not only be able to communicate with one another electronically, but they will also have access to world-wide systems via the Internet. According to the plan, it should be possible to connect all institutions of vocational and adult education by the end of 1998. The project will be discussed in greater detail in the case-study descriptions below.

Using technology to achieve educational goals

A framework for using information technology

According to De Wolf (1992), there are three types of goals when it comes to educational innovation:

- effectiveness goals;
- efficiency goals;
- quality of life goals.

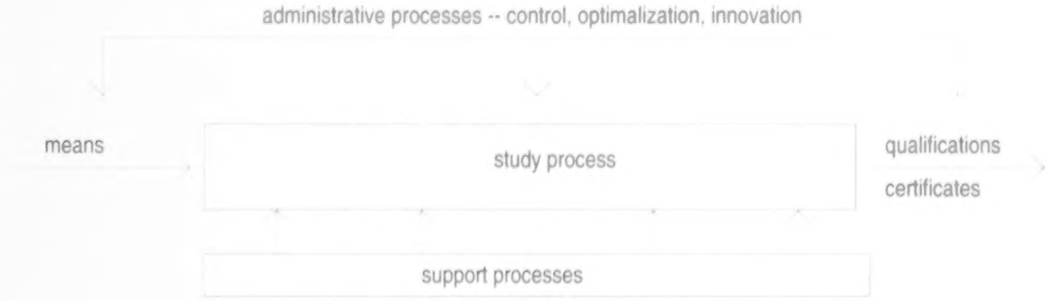
Effectiveness goals focus on providing education and/or instruction to a larger number of students or to different categories of students, or on offering them greater choice within the field of education. When the goal is *efficiency*, the functionality of the studying and learning processes take precedence, with the functionality of the educational institution stemming from those processes. If the point is to improve the *quality of life*, then the goal is twofold: the innovations should be such that teachers feel they are practising an honourable profession which allows them to be creative without constantly having to go to extremes; and they should make students feel that they are not wasting their time taking classes that they get very little out of.

Innovation should be considered "an organised process which has resulted from the changing environment and from new technical possibilities which aims to adjust or improve the effectiveness, efficiency and/or the quality of life of organisations" (De Wolf, 1992). As such, innovation may impact the overall educational process or parts thereof. An explanation follows below.

Categorisation of processes

The categories of main processes that take place within an educational institution can be derived from a reference model for using information technology in higher education (Verreck *et al.*, 1994). To emphasise that the main focus is not on teaching students but on the fact that students learn, however, we prefer to identify the *study process* as the primary process, rather than the instruction and qualification process (Figure 1).

Figure 1 **Educational process with administrative and support processes**


administrative processes -- control, optimalization, innovation
means
study process
qualifications
certificates
support processes

Study process

In its present form, education is organised around the *educational* process in which students must "conform" to the educational institution. Top-of-the-line, modern educational institutions (*i.e.* those that can provide tailor-made instruction) focus on the *study process*, in which the emphasis is on the student. A characteristic feature of the *study process* is that the student and the educational institution work together as partners in the process.

The more closely co-ordinated the student and the educational institution are, the more effective, efficient and satisfying the educational process will be, and the more students will go on to advanced programmes. The poorer this co-ordination is, the more dissatisfaction that will prevail, and the more student dropouts there will be.

The primary process which takes place in an institution can be divided into a number of steps. Kirschner *et al.* (1993) have discerned eight sequential steps in the study process, which can be divided into roughly three phases. Table 1 presents an outline:

Table 1 **Sequential steps in the study process**

Phases of the study process	Steps in the study process
preliminary phase	• Information
	• Intake
	• Advice
implementation phase	• Determine and establish educational track
	• Draw up learning contract
	• Complete educational track
follow-up phase	• Formal testing
	• Award diploma/certificate

The *preliminary phase* begins as soon as a student starts to focus on the *study process* as an expression of a particular "wish", and lasts until the student actually begins the *study process*. The educational institution aims to attract students in this process and to fulfil an intake function in which it helps determine the proper educational track for a student or group of students.

The *implementation phase* is that part of the study process in which the student actually *studies* and practises. The institution plays a supporting role in this phase, frequently by providing instruction during which a teacher conveys information to the students.

Increasingly, however, that role will become more advisory as well. The institution will assist students engaged in independent study, for example by giving them advice, monitoring their progress, etc.

The *follow-up phase* serves to bring the study process to a proper conclusion. In this phase the student investigates to what extent he or she has achieved the goals set in the preliminary phase. The institution's role is one of testing and certifying body.

Support process

The support process encompasses all those activities which an educational institution undertakes to make the study process possible. Some of these activities are: putting together a curriculum, compiling *study* material, drafting tests, scheduling courses, registering student information, and so on. This support process should not be confused with the actual assistance that an institution provides to its students during the primary educational process.

Administrative process

The administrative process in an institution encompasses personnel and financial management and policy as well as quality assurance. The various activities involved including measuring, registering, interpreting and reporting on the number of entering, transferring and graduating students, the recruitment, selection and training of personnel, etc.

In the light of the foregoing, two case studies will be presented in which information technology is being used in the various processes described. The first case study looks at the BVEnet, a project which focuses on implementing an information and communication infrastructure for institutions of vocational and adult education. The second case study describes an interactive course development, storage and learning environment (ILCE) which was designed, developed and is being used at the Open university of the Netherlands, and which various institutions for vocational and adult education also make use of.

Introduction to Case Study 1: BVEnet

The context of this study is the establishment of the BVEnet, a public-sector model project within the national action programme "Electronic superhighway -- from metaphor to action". The BVEnet aims to become a knowledge network for the vocational and adult education sector. The main purpose is to allow this sector to respond more effectively and rapidly to present and future changes generated by the knowledge economy and information society. The BVEnet can be considered an electronic information and communication system which works according to the principles of Internet. It can be accessed by anyone who has the proper infrastructure. By using the BVEnet, institutions (vocational schools and the national bodies for vocational education) will not only be able to communicate with one another electronically, but they will also have access to world-wide systems via the Internet.

Introduction to Case Study 2: ILCE

The Open university of the Netherlands (OuN) develops and provides open higher distance education with a high level of freedom as to where and when and in what tempo to study. The modular system of "guided independent study" courses and credit points allows students a wide range of choices in courses and curriculum; *e.g.* to study single courses, short diploma lines, university degrees, etc. This results in a very heterogeneous student population regarding their study intentions, prior knowledge, etc.

Current learning materials are mainly based on *printed* text books. This is a very inflexible approach that results in two major problems to be overcome:

- The efficiency of the current process of designing, producing and using the learning materials is low in terms of speed of the process, costs, consistency of the materials being developed, flexibility, etc. Also, the revision of the materials implies restarting the complete process.

- The effectiveness of the learning materials as delivered in their printed version is low in terms of their quality and relevance for the individual study process of the students.

The first problem is economic/educational in nature. Aspects of the problem relate to: speed of material development, quality control, flexibility of use of learning materials, possibilities to revise existing materials, possibilities to re-use materials for different purposes (*e.g.* commercial exploitation), degree to which materials are adapted to the specific needs of the student with respect to content level and level of didactic elaboration, etc.

The second problem is an educational/didactic one. Traditional printed courses are based on *a priori* decisions on and selection of basic contents and *a priori* decisions in relation to embedded support (*e.g.* questions, examples, illustrations, tests, schemes, overviews). Taking account of the student could result in adapting basic content and/or the embedded support to characteristics of this student. This results in the provision of demand-driven education in contrast to supply driven education (Kirschner and Valcke, 1994).

Next to the economic and educational problems, a technical problem is emerging. The delivery and distribution of educational materials is becoming increasingly electronic in nature (e-mail, World Wide Web, FTP-sites). The current set of materials is not suited for delivery in these environments; large texts, little structure, no built-in possibilities to select or remove parts of the materials, and lack of integration of printed media with more dynamic media (*e.g.* audio, video, CAI, tools, etc.). These problems urge us to find a new design and development approach to the learning materials.

In order to deal with economic (time, money), educational and technological problems in the development, production and exploitation process of learning materials (text-based and multi-media) for distance education, a project was set up called "Interactive Learning and Course Development Environment (ILCE)". This project focused on researching, designing, and developing a computer-based system to support the work of course development teams and tutors on the one hand and students on the other. The complete system is now available and is used -- apart from OuN-related applications -- as a part of a training package to support other educational and professional organisations to master the basic principles of developing a distance education environment and of applying them in their own setting.

IT projects in and for education: trends and examples

This section of the paper surveys[1] the overall situation in adult education as it now stands in the Netherlands and lists a number of spearheads in terms of knowledge, applications and operational research related to the use of information technology.

The description that follows is organised according to the processes that take place within an educational institution, as described above.

Primary process

Interactive media and multi-media technology can be used to support the study process. By *interactive media* we specifically mean the personal computer, its use varying from instruction to practise and simulation. The development of interactive media has largely depended on the creation of interactive potential and computational power of the PC. *Multimedia* technology brings together the interactivity already present in the PC and high-quality (moving) images and sound. The development of multimedia has depended more on advances in audio-visual media, with digital techniques playing a key role in improving and making such media easier to use. Multimedia technology has entered the realm of education in the form of interactive videos and, more recently (and more specifically geared to the consumer market), compact disks, CD-I and related media. Although these applications have been around for quite some time now, their use is still not very widespread.

Advances in the use of *hypertext* and *hypermedia* merit special attention. In essence, this technology presents information in the form of content elements and the relationships between them (content elements/relation networks). Users find their way through the network based on their own needs and wishes. The most recent application of this technology is the World Wide Web, where, in combination with telematics, it can theoretically provide access to an unlimited amount of information.

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[1] This survey should not be considered complete.

Another trend is the development of "*authoring* tools" for more effective and efficient development of courseware and/or study materials. Many universities and businesses have set up R&D projects on this technology which aim to develop programmes/systems suitable for creating hypermedia/multimedia applications. In addition, there are also studies focusing on the possible use of these technologies, for example by teachers.

In addition to interactive and multimedia facilities, *telematics facilities* (for example networks, satellite connections) increasingly serve to support the study process at the micro level. Telematics (telecommunication + information) stands for applications which connect students to locations other than where they are, whether at school or at home. The "means of transport" include electronic mail, videotext or two-way cable. It is important to note that there is a difference between direct and time-delayed communication. Direct communication involves "real time" (simultaneous) interaction between, for example, a teacher and a student. A familiar example is teleconferencing. With time-delayed or asynchronous communication, the participants can only respond to information that they have received after a period of time has passed. That happens, for example, when teachers and students communicate by sending each other electronic mail messages, or when students communicate with an electronic database located elsewhere.

In general, institutions of adult and vocational education have done very little in the way of courseware development themselves. That is only logical, as it is an expensive and time-consuming activity. To date most of the applications have been authored by enthusiastic teachers. The public sector has also done very little work on developing educational programmes. The Dutch market is small and highly competitive. Moreover, there are no basic guidelines for using IT in education. Many programmes do not yet have exit qualifications or examination requirements in the field of IT.

Until now, most of the courseware has been developed by or within large educational institutions. Such projects are frequently subsidised (in part) by the government and/or through co-operative ventures with trade and industry. In addition, a growing amount of courseware is being purchased from abroad and translated into Dutch.

Information technology can be used to *plan* and *monitor* the *study process/educational track* in order to assess student progress. One clear example is a student monitoring system. Current applications in this area still have the teacher monitoring student progress, but there is a recent trend towards developing systems which allow students to monitor themselves.

The *follow-up phase* increasingly relies on *item banks* and *test-service systems*. Compiling, administering and correcting tests is a time-consuming activity in educational practice. Test-service systems play an important role in facilitating and improving tests. They generally consist of a (partially) computerised system with a number of functions for storing, locating and selecting test items, printing tests and processing them (including calculating and reporting test features). The system assembles a large number of test items into one huge database, known as an item bank. It is possible to create a test automatically from the item bank by entering a number of selection criteria. The test results can be analysed, making it possible to acquire information on the quality of the test and the items used. Centrally located item banks are common; schools have access to a number of these via a network connection.

Preliminary phase

Project description: Information service for institutes of upper secondary vocational education (MBO)

Aim
Revitalisation of support processes.

User group
No one main user group (teachers, students, etc.) has been identified. Ultimately the user group will include the staff of the MBO institutes participating in the Consortium for Innovation (CvI).

Result
The result will be the supply of information and services via a future WWW server, making use of a Consortium house style (still to be developed). Users will be able to start at the homepage to find information by and about the MBO institutes that participate in the Consortium.

Advantages
Use of a medium that can supply an up-to-date, wide-ranging, constant flow of information on the Consortium and its affiliated MBO institutes.

Participants, basis of support
The project will be funded by the nine MBO institutes located throughout the Netherlands. Together they provide courses for 80 000 students and employ 7 000 staff.

Implementation phase

Examples of *multimedia/courseware* projects/initiatives are:

- multimedia productions and courseware developed by the Open university of the Netherlands, an institution which provides "second-chance" and "second track" higher education for adults. The productions and courseware are an integral part of most of the Ou's 350 courses (some examples are the Assessment Centre Practical and the Histology Pathology Practical)
- the vocabulary/CD-I project "Dutch as a second language", for immigrants to the Netherlands who have attended higher education (PRINT/(OI)VE).

Examples of *telematics* initiatives focusing on the primary study process:

- Utrecht University's GISET-PROJECT has resulted in an on-line Geographical Information System for Educational Purposes.
- The Open university's StudieNet project aims to develop a prototype network facility to assist Ou students with self-guided study.
- Dirksen tele-education (Dirksen Training Informatics and Electronics) allows students to study at home while still keeping in touch with a teacher, fellow-students and the educational institute itself. ECOM (Electronic COMmunication) at Royal PBNA in Arnhem is a telematics application which runs on a computer and a modem. The system allows students and teachers to

send homework and corrections back and forth. It also assists in tutoring. LOI (Educational Institute of Leiden) uses Digimail, an electronic method of sending corrections. Students and teachers send homework and corrections back and forth by modem.

EDI (Electronic Data Interchange) is an example of a new trend in which increasingly complex IT applications developed in trade and industry are being used for educational purposes:

- A fair amount of the instruction provided by the OVD (Training Institute for the Distribution Sector) is by means of EDI, which computerises external communication. In an EDI system, standard-format messages are exchanged via a data network connecting the computers of the participating organisations and educational institutions. The messages can be deciphered by the computers and are therefore immediately available for further electronic processing.

With respect to the study process, IT is deployed at yet another level, specifically to *provide information* on and *distribute* instructional tools based on information technology. To some extent this involves the development and use of databases which contain information on such new tools.

Examples of projects and initiatives which provide information on courseware for adult education and upper secondary vocational education are:

- The NITVE project (a teaching aids database for adult education) has developed a computerised bibliographic file on disk. The file contains information on educational software and information-science teaching tools. The system is intended for tutors and teachers in adult education.

- ECCLES is an on-line information system. A modem and computer can be used to obtain descriptions of educational software packages. Right now about 800 different descriptions can be downloaded. There are also independent evaluations available for some of the packages. Educationalists, psychologists, teachers and subject specialists evaluate new software. The descriptions are compiled from their reports and the various positive and negative points of the programmes are backed by arguments.

- PTH Softwarebank is the database of the Dutch Technical Teachers' Training College in Eindhoven. The database offers teachers the possibility of reviewing and testing programmes (on computer and by modem). It is not possible to make copies. The database is subsidised in part by the Ministry of Education, Culture and Science. Schools can subscribe to the database.

With respect to the distribution of information technology in education:

- One of the VBVE's (Foundation for Vocational and Adult Education) most important activities is to distribute previously selected applications software to schools. Funding supplied by the Ministry of Education, Culture and Science is used to purchase the most popular standard packages and deliver them to schools. There is also a software catalogue from which schools can order. In this capacity VBVE serves as a broker between the software houses and schools, with prices being kept quite low.

- The Foundation for University Computing Centres (SURF) arranges special licensing agreements for the distribution of commercial software packages usable in higher education to students and staff members of universities at sharply reduced prices.

Follow-up phase

- The Open university's SYS system is a test-service system consisting of an item bank and procedures for generating, assessing and analysing tests. The items are either multiple-choice or true/false questions. The item banks are developed and maintained at the Open university's main campus in Heerlen. The item banks are distributed via a Wide Area Network (WAN) which connects the central campus and the study centres. The students can sit the examinations at the study centres. SYS will be superseded by the ITEM system, which will make flexible and open testing, as well as progress testing, possible.
- VELO (Association for Logistical Training) is a co-operative venture between six schools of logistics. VELO is developing a logistical item bank. The intention is to create a central database which can be consulted by modem.
- The SOM (Foundation for Training in the Metal Sector) has made tremendous strides in developing an item bank. The most important aim is to increase efficiency.

Project description: Tele-testing

Aim
This project consists of three sub-projects which will be implemented simultaneously. The aim of the first sub-project is to demonstrate the EXIN Billboard system (BBS), which was developed in 1994 and allows for the transfer of examination and answer files. The other sub-projects aim to develop decentralised tests and to encourage discussion of this subject.

User group
Students, teachers, infrastructure managers and administrative personnel.

Result
A service which ensures reliable file transfer of examinations and which makes decentralised administering of tests possible.

Advantages
- the system allows for rapid, effective, simple, user-friendly and reliable file transfer between school locations;
- it is a user-friendly way of administering a test decentrally;
- it will make know-how in the field of "tele-testing" widely available.

Support process

As tools, *networking*, and more generally *telematics* play a direct role in terms of providing new means of exchanging information and communicating. E-mail, an example of asynchronous communication, and "electronic conferences", an example of real-time communication, are new tools which can be put to good use in education. More important still is the role that telematics plays in the form of local and interlocal networks. Such networks are gradually becoming common and are used for various different purposes in educational institutions. Their functions are clearly an extension of (or a requirement for) other applications and types of use. Networks are chiefly important as infrastructures which make new (and in many respects not yet complete) forms of education and teaching possible. Indirectly, their role is to overcome practical obstacles with respect to information exchange and communication and identify more effective and efficient solutions in this regard.

Telematics *facilities for students at home* generally involve information technology which is intended to provide an integrated working environment within which the student can focus on a variety of activities, aims and functions related to his/her course of study. This working environment will consist of and must combine a large number of the tools and functions described above.

Infrastructural developments and applications in the field of telematics are taking shape in the following projects and initiatives:

- An experiment on tele-learning in upper secondary vocational education carried out in 1991/1992 at the MBO institute "De Rooi Pannen" had two goals: (1) to explore the use of telematics, in the form of tele-learning, for educational purposes, and (2) to investigate whether the use of tele-learning would alleviate traffic congestion or distribute it more evenly.

- A project involving tele-working for teachers at Abstede College (institution for vocational education) and MTS Scutos (institution for technical vocational education) is intended to help teaching staff prepare their lessons. In the future, teachers will be able to consult a central database to produce overhead sheets and request the images they require. They will also be able

Project description: Hospitality Sector Educational Centre

Aim

The project focuses on the primary process, support, organisation, and management. The goal is to improve the flows of information regarding educational renewal, teaching tools and aids, and school and career counselling programmes between the national vocational education bodies for the Hospitality Sector, Institutional Kitchens, Contract Catering, Tourism and the companies that employ trainees.

User group

Teachers, advisers, support staff (mentors, deans, student counsellors), middle and central management, the board and the instructor/tutor for the apprenticeship scheme in which they participate.

Result

The result is a knowledge service which provides:

- an electronic newsletter;
- information on the qualifications structure: the exit qualifications document, including a description of the modules; and
- examples of the operational exit qualifications.

Advantages

The system makes an up-to-date knowledge infrastructure available to users at any time of the day. It facilitates interaction between the users, allowing them to ask and answer questions and to discuss and exchange views.

Participants, basis of support

All schools in the hospitality sector and 10 to 20 companies providing trainee posts will be connected by mid-1995.

to send or receive announcements, schedule changes and grades to and from school or request such information from a central file.

Administrative process

One of the developments which has been set in motion is the movement from a management and/or scheduling system to *student registration and monitoring systems*. Another rising trend is that such systems are increasingly being integrated into other components of educational practice, such as the study process and testing. This section reports on a number of applications which attempt to integrate various educational components.

Examples of integrated applications

- The APS (General Pedagogical Study Centre) in Amsterdam has developed a participant service system (DSS) in collaboration with a number of other organisations. Originally American, this system is now used at universities and institutes of higher vocational education.

Project description: VBVE (Foundation for Vocational and Adult Education)

Aim
To provide the information and services offered by the foundation to users by setting up a WWW and FTP server. The demonstration project involves conducting preliminary research, constructing a prototype and providing information from the foundation.

User group
Middle management within the various industrial sector groups and the central management of the educational institutions involved.

Result
The result is a knowledge service which makes information available on:

- policy trends, via the "BVE-Actueel" organ;
- quality assurance;
- industrial sector groups. It also provides information to these groups (communicating the latest trends and developments);
- educational programmes;
- institutions;
- projects, including Impuls and others being carried out in vocational and adult education.

Advantages
The information provided is up-to-date, timely, and widely available.

Participants, basis of support
The foundation is working closely with other foundations and organisations to ensure that the information is linked to that provided by institutions about the various programmes.

- PRINT/VE has developed an IDBS (intermediary database system), a joint database system which allows the various component packages to supply and obtain data. The system can be viewed as a sort of interface between a central student administration system and local "educational" applications such as an item bank, a test-administration and -processing package, a student monitoring system and an intake/student counselling package. The data in the system are coded in such a way that communication with the various systems connected to it is flawless.

- PROBOL (Production Company for Open Learning) has a management information system (MIS) consisting of four different components: a student administration system, a personnel system, a scheduling/calendar system and a financial information system. The MIS is multi-sectoral and integrated.

Case studies -- Networks and materials

BVEnet

The BVEnet project (BVE stands for Vocational and Adult Education) was initiated by the Ministry of Education, Culture and Science. Its purpose is to encourage vocational institutions, institutions for adult education and the national trade sector bodies to make use of information and communication technology and to take full advantage of this technology within vocational/adult education and the shrinking labour market (specifically SMEs -- small and medium-sized enterprises). In concrete terms, the BVEnet is an electronic communication and information network which offers pedagogical support, and administrative applications and services to various target groups in a user-friendly fashion. It is *not* a closed technical network, but rather a "logical" network of people and organisations which makes use of existing technical networks that can be accessed according to Internet protocols. Vocational schools, institutions for adult and continuing education, the national trade sector bodies, teachers and students can still be connected to the network during the present legislative term. The network is also open to businesses and knowledge institutes (both public and private), so that new stores of knowledge can be introduced more rapidly into educational programmes and a more direct relationship will evolve between education and the business community. That will be made possible, on the one hand, because students will contribute their advanced knowledge of IT and telecommunications to the SME sector. On the other hand, by participating in the BVEnet infrastructure, schools will be better able to supply new types of distance learning in the form of "tailor-made programmes" for use in SMEs, considerably reinforcing the innovative power of the SME sector. In this way the BVEnet will make a concrete contribution to reinforcing the knowledge infrastructure in the Netherlands.

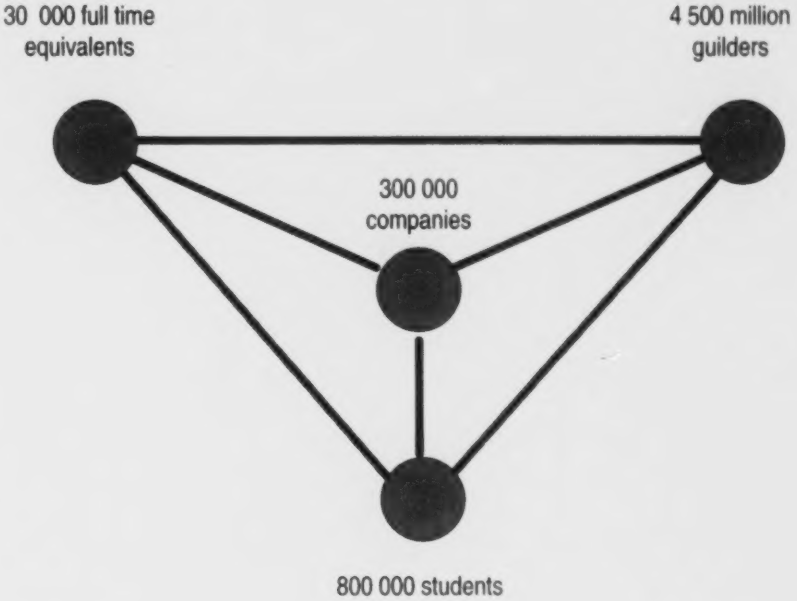
Target groups

- The vocational and adult education sector

The BVEnet's primary target groups are: 800 000 students, 40 000 teachers, 300 schools, 20 national bodies for vocational education, and trade and industry (sectoral organisations and SMEs).

Almost 50 per cent of all secondary-school students between 16 and 19 years are enrolled in a secondary vocational education programme. There are 270 000 students enrolled in upper secondary vocational education programmes, with approximately 150 000 companies providing them with trainee posts. There are approximately 150 000 students in the apprenticeship system; they fill apprenticeships in about 64 000 different companies. There are another 80 000 adult students enrolled in part-time upper secondary vocational education programmes or taking vocational courses. Around

75 000 adults participate in general secondary education, and 150 000 in basic adult education. The Ministry of Education, Culture and Science has set aside a budget of 4.5 billion guilders for vocational and adult education.



- Direct external partners

Vocational education has traditionally had a very close relationship with trade and industry. Upper secondary vocational education and the apprenticeship system are purveyors to the growing SME sector. Institutions collaborate with about 300 000 (regional) businesses in traineeship, work-study or contract-education programmes. There is also an increasing demand by the Employment Service for contract education. It is particularly important in vocational education that students acquire knowledge and skills that closely match the needs of the labour market. To ensure that this happens, educational institutions, sectoral organisations and businesses have designed a qualifications structure for full-time vocational training programmes. The required educational levels and exit qualifications are based on the relevant professional profile. There is already a qualifications structure for the apprenticeship system, which is regularly altered to satisfy new training requirements.

The vocational and adult education sector has both sectoral and regional contacts with trade and industry.

- *Sectoral*: Educational programmes are drawn up by the national bodies for trade sector education (LOBs) in co-operation with businesses and the Vocational and Adult Education Council (still being set up). There are 20 LOBs in each industrial sector (for example metalworking, process technology, installation technology), and the educational programmes are modified continuously to satisfy the requirements of professional practice. The LOBs monitor the quality of the programmes and the companies offering trainee posts, and they administer examinations. In addition, they supervise the students and the companies during the course of the programme. Finally, the LOBs are responsible for the above-mentioned qualifications structure.

- *Regional*: There are direct regional relationships between educational institutions and the local business community in the form of traineeships, work-study programmes, contract teaching or more concrete co-operative projects. In addition, co-ordination with the regional labour market requires constant communication with the Employment Service, the municipal authorities and the regional business community. The institutions (adult education and settlement programmes for immigrants) are financed in part by the municipalities/designated cross-border co-operation regions, encouraging a high level of response to local/regional requirements.

Bvenet: basic principles and aims

BVEnet is primarily concerned with creating new network applications and services, and not with providing the necessary infrastructure. The expectation is that advances in the technical infrastructure will soon be such that it will become both inexpensive and "easy" to use. BVEnet will not have its own dedicated network, because:

- the installation costs would be too exorbitant;

- it is important to establish relationships with other networks and communication channels;

- students and teachers must be able to access the network from wherever they happen to be.

BVEnet is a logical electronic communication network which uses existing Internet facilities and protocols as its means of communication. The Internet was selected because its underlying protocols and network functions have found wide acceptance amongst users and suppliers. It was also selected for its non-hierarchical structure and because access costs are (relatively) low.

The focus of the project is to develop applications and services for the BVEnet which will support the sector's primary processes (learning, teaching and communicating). These applications and services will involve providing information, content-specific services and communication/interaction. The project employs the concept of the "learning network", meaning that not only the student, but that the teacher and the management also learn, as does the network itself through a process of growth and change. It is a network of human resources in which:

- students and others involved are encouraged to pursue independent learning;

- there is an exchange of knowledge, skills, experiences and contacts between educational institutions, organisations and the labour market (trade and industry);

- the social/educational interaction between teachers, students, management and the institution's environment is maximised;

- information and communication become highly accessible.

The BVEnet structure is bottom-up. The network's providers and users, *i.e.* those who wish to add information, communicate, or have access to the information made available, are the most important parties. It is they who will largely determine the network's development. As a result, the

BVEnet project must be able to evolve without having first to consider who is to provide which service and which infrastructure.

Ultimately BVEnet should loosen the ties that bind the study process to the physical location of the students, teachers and institutions. Teachers, management, students and companies will have easy access to information and knowledge from around the world. That will be a tremendous encouragement for the renewal of education, which will evolve into a continuous, relatively autonomous process as a result.

Approach

In view of the basic assumption that BVEnet should focus mainly on supporting the sector's primary process, BVEnet project could evolve along the following dimensions:

- the development of didactic concepts which make use of information and communication technology as learning and teaching tools. Some examples are: tele-learning, simulations of professional situations ("interactive arc-welding"), and so on;
- support processes, such as school and career choice systems, electronic test systems, educational software tools, interactive teaching toolbox, and so on;
- administrative and management systems. This refers to: student registration systems, student monitoring systems, information pertaining to educational programmes;
- developmental tools and instruments for distributing results. It is the explicit intention to use BVEnet to develop (joint) programmes and lesson material.

The dimensions listed above also assume that information and communication technology should be viewed as technical and professional developments in their own right, and that they should therefore be considered a suitable subject of study. In addition to a basic knowledge of information and communication technology (including e-mail networks), other examples are: teaching simulations, computer-aided design, etc.

BVEnet is a site where all those involved have access to the products and services on offer. The participants can be divided into three different groups or levels. First of all, there are those "in the field": the students, teachers, management, and the internal systems specific to a particular Regional Training Centre (Community Colleges). Secondly, there is the regional level (Regional Training Centres, relationships with external partners). Thirdly, there is the central level, which focuses on vocational and adult education as a sector and oversees communication with the government, trade and industry nationwide, and so on. The point of BVEnet is to create a largely decentralised information system which is transparent in terms of its contents and its use.

ILCE

Description of the ILCE architecture

The ILCE-project develops and researches an integrated computer system for the development, production and exploitation of the learning materials. The system is based on a two-sided architecture: *a development system* to design and produce the materials and *a delivery system* that helps to select specific materials for the student and supports their delivery in a printed and/or electronic mode. A more detailed description of the theoretical basis and the design approach of the ILCE-system can be found in Vuist (1995) and Vuist and Valcke (1995).

- Hardware, software and networks

The *development system* of the ILCE-architecture makes use of Smalltalk® V (Windows® version), an object-oriented development environment especially suited for rapid prototyping. The object-oriented nature of this environment is optimally suited to allowing the ILCE-user to continually update the objects and classes that he/she defines and embeds into already existing learning materials. The development system is also linked to a commercial word processing environment; *e.g.* MS-WORD® that functions under Windows® 3.x. This means that the data types of the learning materials are not restricted to simple text or static graphics but that audio, video, etc., can also be integrated into the materials. By making use of OLE's (Object Linking Environments) it is also possible to integrate external applications such as computer assisted learning programmes, simulations or standard tools such as SPSS® or calculators.

Minimal hardware requirement for the use of ILCE is a stand-alone 486 PC with a minimum of 8 MB RAM and a sufficiently large hard-disk. A larger RAM (16 MB) and faster processor facilitates the development activities. The development environment is, at the time of this writing, not yet implemented as a network-based system.

The *delivery system* has been realised by making use of existing Internet-viewers as will be explained later in this text. To implement the interactivity and flexibility necessary to compose tailor-made courses, special engines written in C++ are added to the materials. These engines can be activated in all regular Internet viewers (*e.g.* Netscape®, QuarterDeck®, I-View®, etc.), supporting the HTML 3.0 language standards. The use of an Internet viewer does not mean that students download the learning materials from a server. For security and legal reasons, the large sets of materials are sent to the student on disks as compressed files. With a simple set-up command all of the learning materials are automatically installed onto the student's hard disk. CD-ROM use is foreseen when the file size is too large for floppy disks.

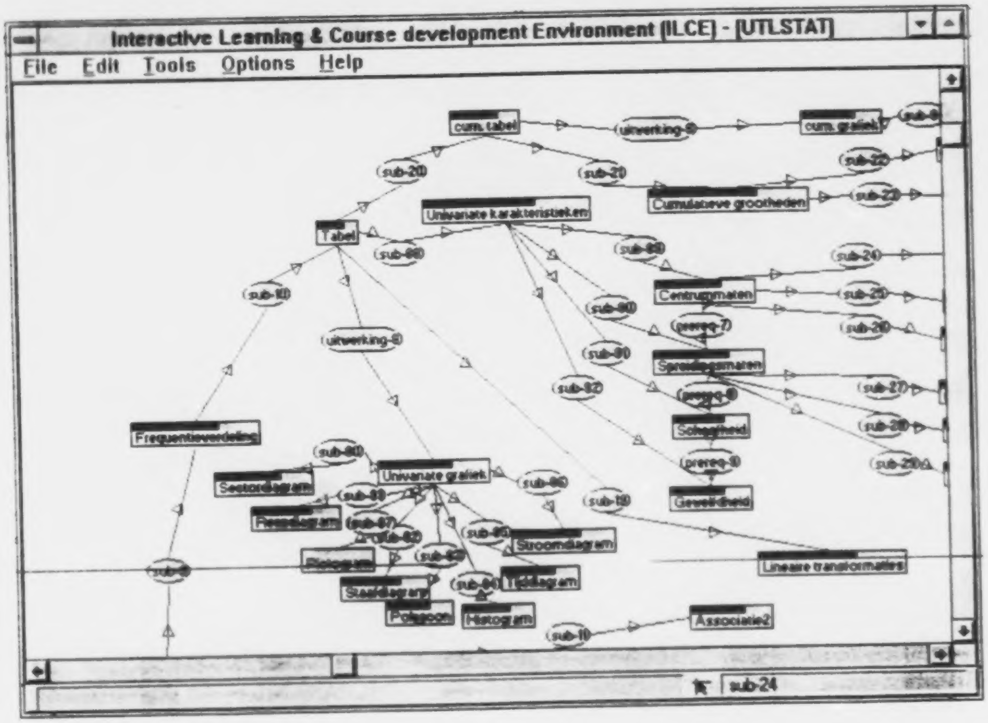
At the hardware level, a stand-alone 286 PC with 8 MB RAM is workable although a more powerful processor is recommended. When the learning materials contain audio or video, the student machine must also contain multi-media possibilities.

A commercial version of the ILCE-environment will be available on a license-basis. A license guarantees support and version updates for a year.

The *development system* is used by course and materials developers. They mostly work in multi-disciplinary teams consisting of domain experts, instructional designers, educationalists, authors, etc.

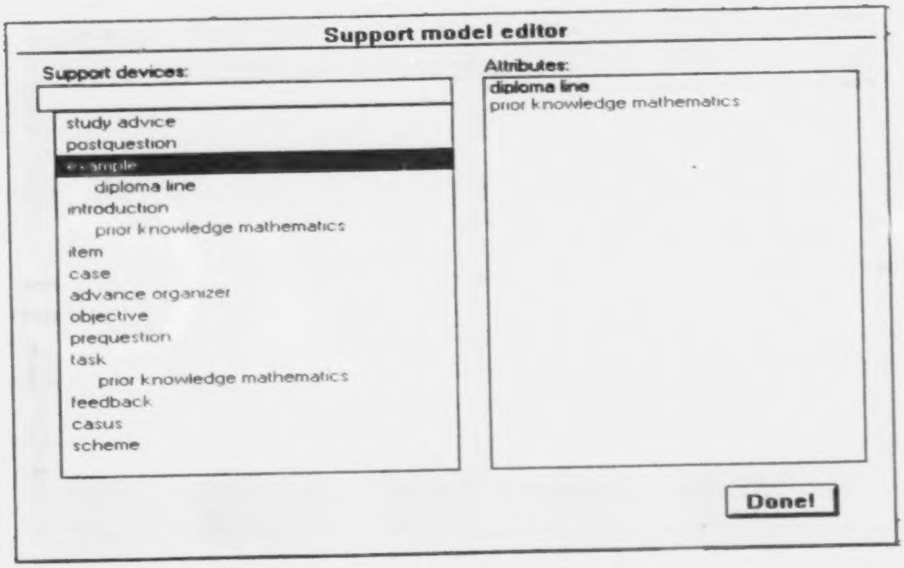
This part of the ILCE-system necessitates this team to explicate beforehand a course model. This course model consists of four integrated models, namely: a content model; a support model; a student model; a learning path model.

Figure 2 **Building a content model**


Interactive Learning & Course development Environment (ILCE) - [UTLSTAT]
File
Edit
Tools
Options
Help
cum. tabel
uitwerking-8
cum. grafiek
sub-20
sub-20
sub-22
Cumulatieve grootheden
sub-23
Univariate karakteristieken
Tabel
sub-80
sub-80
sub-24
sub-10
Centrummaten
sub-25
prereq-7
sub-26
uitwerking-8
sub-80
sub-80
Spreidingsmaten
sub-82
sub-27
prereq-8
sub-28
Frequentieverdeling
Scheefheid
prereq-9
sub-29
sub-80
Univariate grafiek
Sectordiagram
sub-80
Gewelfdheid
sub-88
sub-10
Puntdiagram
sub-87
sub-80
Stroomdiagram
Lineaire transformaties
sub-8
Staafdiagram
sub-80
Tijddiagram
Polygoon
Histogram
sub-10
Associatie2
sub-24

A *content model* of the domain [(semantic network that can be compared to an elaborated content table of the themes/subthemes to be dealt with from a scientific point of view (Figure 2)].

Figure 3 **Designing a support model**


Support model editor
Done!

Support devices:

- study advice
- postquestion
- example
  - diploma line
- introduction
  - prior knowledge mathematics
- item
- case
- advance organizer
- objective
- prequestion
- task
  - prior knowledge mathematics
- feedback
- casus
- scheme

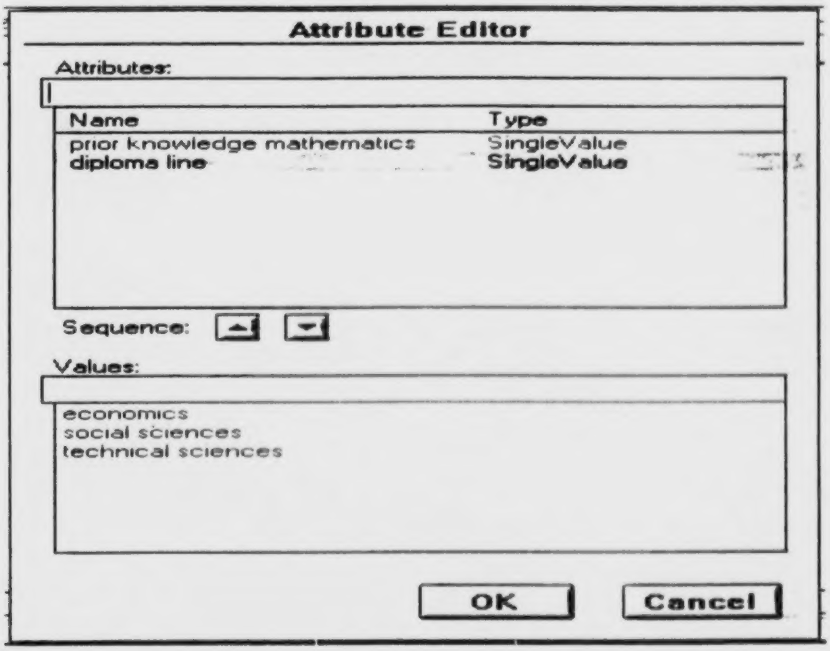
Attributes:

- diploma line
- prior knowledge mathematics

A *support model*, indicating what kind of embedded support devices (examples, questions, schemes, illustrations, tests, content pages, etc.) will be available as a default set (Figure 3). Embedded support devices can be considered as the in-built tutor that helps (a) to orient the students through the materials; (b) to process the materials in relation to the mastery of the objectives and (c) to test their mastery of the objectives. In Ou-materials more than 50 kinds of embedded support devices (ESD) can be distinguished. They serve specific functions and effects. Depending on the objectives and the particular nature of the content domain, specific subsets of ESD are considered to be of help for the students to study the materials independently.

A *student model* indicating in relation to what variables materials will be exploited in a flexible way (*e.g.* future profession, content domain, diploma programme, etc.).

Figure 4 **Defining important student attributes to be considered in the student model**



Name	Type
prior knowledge mathematics	SingleValue
diploma line	**SingleValue**

economics
social sciences
technical sciences

The student model (Figure 4) can be linked to the content model and the support model. Examples of the former indicate that for instance different learning paths are related to different study levels, professions or content domains. Examples of the latter result, for instance, in the development of alternative examples for students of different content domains; a statistics course incorporates different examples for economics or social science students.

A model of the *learning path* that indicates the sequence by which a student will deal with the consecutive themes/subthemes in the content model (see Figure 5).

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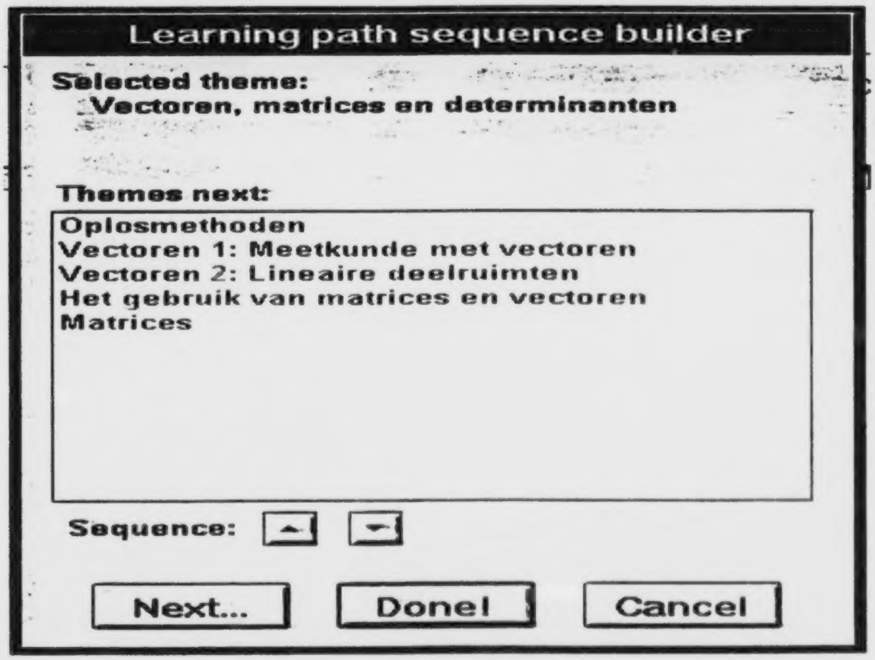
After defining the course model, the building module facilitates the writing and editing of the learning materials by presenting templates (see Figure 6), making automatically links, controlling input, facilitating import of data-elements, etc. The templates are used to control *e.g.* an editor such as Word 6.0.

The result of working in this environment is a large set of structured and indexed learning materials (texts, pictures, audio, etc.) which can be assigned as the *repository* of learning materials.

Students/tutors interact in the *delivery system* with the repository of learning materials. The student is first asked to respond to the student model, available in the repository base. In this way the system knows what the specific values are for the selection procedure: *e.g.* low prior knowledge about statistics or study intentions in the domain of natural sciences. The result of this interaction is a selection profile that helps to extract from the repository only those materials that are relevant for this student. At this stage, a course is defined for the individual student.

Figure 5 **Defining the learning path**



Selected theme:
Vectoren, matrices en determinanten

Themes next:

- Oplosmethoden
- Vectoren 1: Meetkunde met vectoren
- Vectoren 2: Lineaire deelruimten
- Het gebruik van matrices en vectoren
- Matrices

The *delivery system* also helps the student to work with the selected set of learning materials (the course). The delivery system can be considered as a "viewer". Different viewers can be designed depending on the demands of the user, corporation or institution: Internet-viewers, interactive viewers that access the repository on a CD-ROM, a viewer to realise a printed version of the learning material selection, etc.

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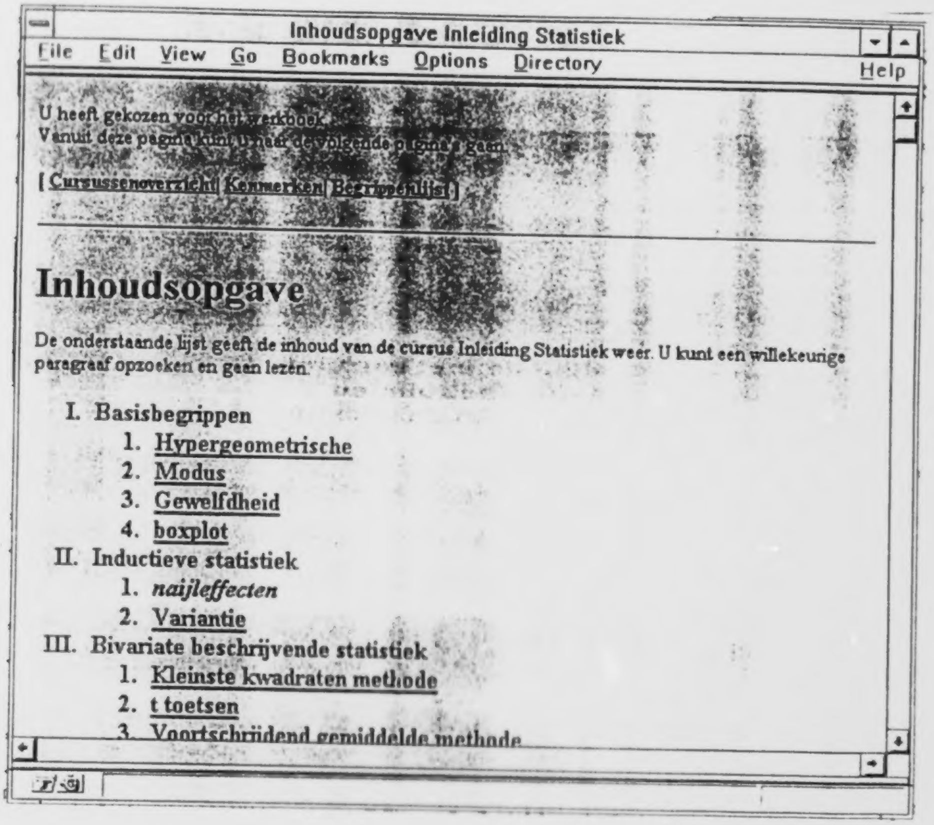
As stated earlier, different types of delivery are supported: *e.g.* 1) Printed delivery. Here the student decides to print out his course (or a part of it); 2) Interactive delivery. In this mode the student studies the materials from screen. Especially the interaction with the embedded support devices are relevant in this environment. In interactive viewers, students can, for example, construct study modes (browse mode, test mode, rehearsal mode, etc.) to work through the materials. They actively select, deselect, manipulate, explore, etc., the selection and make use of integrated tools to study (*e.g.* SPSS, CAI-packages). Especially the possibility to link to the ILCE-system other computer-applications extends this functional value to enrich the interactive learning environment.

Figure 6 **Defining the structure of the learning materials for a specific theme in the content model**



U heeft gekozen voor het werkboek.
Vanuit deze pagina kunt u naar de volgende pagina's gaan.

[Cursussenoverzicht | Kenmerken | Begrippenlijst]

Inhoudsopgave

De onderstaande lijst geeft de inhoud van de cursus Inleiding Statistiek weer. U kunt een willekeurige paragraaf opzoeken en gaan lezen.

I. Basisbegrippen
    1. Hypergeometrische
    2. Modus
    3. Gewelfdheid
    4. boxplot
II. Inductieve statistiek
    1. *naijleffecten*
    2. Variantie
III. Bivariate beschrijvende statistiek
    1. Kleinste kwadraten methode
    2. t toetsen
    3. Voortschrijdend gemiddelde methode

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Impact of the case studies on practice, research and policy -- How technology facilitates education

BVEnet

Current projects

- Demonstration projects

The core of BVEnet's 1995 plan of action is to identify knowledge services which can demonstrate the added value of electronic communication and information exchange for vocational and adult education. It is expected that these projects will awaken the interest of the target groups and increase their willingness to invest in the network.

The project management is currently preparing to run approximately 60 demonstration projects (see Appendix). As a group these projects are evenly distributed amongst the primary, support and administrative processes.

- Public information

Public information activities play a crucial role in keeping the vocational and adult education field informed of developments within BVEnet.

- Organising the network

The main activities are to connect to the world-wide Internet ("Internet protocols"), to design and set up a vocational and adult education homepage and to negotiate with "service providers" so that everyone has direct and user-friendly access to information and programmes which are relevant and specifically related to the vocational and adult education sector. A further activity is the introduction of EURO-ISDN within and between the participating institutions and businesses (a spearhead of European Union policy).

- Provision of information

As of July, the Dutch Parliamentary Documentation Centre has been using the network to distribute any information on the vocational and adult education sector which has been discussed in the Upper and Lower Houses of Parliament. Official announcements by the Ministry of Education, Culture and Science (those included in the "yellow cahiers") will become available on BVEnet this year.

- In-depth projects

A number of in-depth projects were launched in 1995, and the following proposals are being considered at present:

- encouraging the participation of women in BVEnet activities;

- simulations related to teaching practice;
- innovative forms of tele-learning and computerised lesson packages;
- encouraging interactive PC use.

- BVEnet -- The learning network; design

It is very important that the BVEnet be uniformly accessible and have a harmonious design. This long-term project is divided into three stages:

- the design of an "Adult and Vocational Education Plaza" in the Digital City environment;
- the design of a central site for vocational and adult education. The site will be comparable to the existing Digital City in terms of size and complexity (but it will not be located within the Digital City);
- the design of a virtual site for vocational and adult education. It will take very little time to develop BVEnet. In just a few years the network will consist of a decentralised collection of databases, knowledge bases, software and communication lines which will be more or less integrated into other network environments.

- External partners on the BVEnet

A study is under way investigating whether and how a number of selected sectoral organisations can gain access to BVEnet, the nature of the information to be exchanged, and the communication between these organisations and participants in the field of vocational and adult education.

- Investment by third parties

Given the scope and the aims of BVEnet, the project initiators began to search for co-financing from the very start. These efforts have produced some positive results. First of all, KPN (Dutch PTT) has signed a declaration of intent for the provision of knowledge and facilities. In addition, trade and industry are investing in the network by (co-)financing the demonstration projects. The Ministry of Economic Affairs is providing funding for projects which promote access to external partners. Finally, the schools themselves are contributing both financial and human resources to the network, for example in the demonstration projects.

- Monitoring

The Open university's Centre for Educational Technology and Innovation (OTIC) in Heerlen is monitoring BVEnet's progress.

Bottlenecks

The various bottlenecks which the BVEnet project is presently grappling with are no more than the "usual" difficulties experienced by information and communication technology projects of this scope. Four of these bottlenecks are:

- Infrastructure

The development of BVEnet is contingent on the development of services. However, it appears that the infrastructure at the schools themselves lags behind what is desirable and necessary. There are a number of reasons for this, such as:

- the high cost of investing in infrastructure;
- the high cost of hiring in the know-how to establish a connection to the network;
- "fixed costs" such as telephone bills, etc.

- Internal network facilities

This bottleneck is related in part to the infrastructure problem mentioned above. Optimal use of BVEnet is only possible when the internal network facilities at a Regional Training Centre are up to snuff. That places a heavy burden on schools in terms of investment, expertise, recruitment of network staff, and so on. The relationship between what is needed internally and what is required externally is still a developmental issue for schools in which both substantive and technical issues play a role. Moreover, the network facilities vary considerably from one institution to the next.

- Commitment of school management

Because management tends to be relatively unfamiliar with information technology, decisions on necessary and strategic investments are frequently taken too late or not at all. It is therefore highly important that management have some form of training in this area.

- Financing

This obstacle is closely related to the previous two. It is expected that the interest generated by BVEnet project will result in a lack of sufficient financial resources. In turn, it is possible that the educational institutions will not be able to make satisfactory use of the opportunities provided by BVEnet in their primary process.

Organisation and financing

The organisation of the BVEnet is a reflection of the bottom-up principle. The vocational and adult education institutions and their direct external partners (industrial sectors) give BVEnet its basis of support. A project management team has been appointed which co-ordinates the various initiatives, reports on the network's progress, contracts project participants, drafts plans of approach and carries out the various information, communication and evaluation activities.

The BVEnet Advisory Council will provide solicited and unsolicited advice to all those involved in setting up BVEnet during the project's initialisation stage (to 1996). This advice will cover every topic which the Council deems important for the development of BVEnet. The Council consists of representatives of schools, LOBs, the Digital City movement and the SME sector. The Council was established by the Ministry of Education, Culture and Science.

The ministry is both the commissioning and the subsidising body for the project. It manages the entire affair, determines the policy on BVEnet and decides on the plans of approach, project proposals, etc.

BVEnet receives funding from both public and private organisations. Given the nature of this document, only a brief description will follow.

On the public side, vocational and adult education's management in the field contributes to the BVEnet budget. The expenditure plan for vocational and adult education has set aside a budget of 4.8 billion guilders for the "Vocational and Adult Education Technology Policy", to be applied towards BVEnet demonstration projects, setting up a digital workplace, and developing more in-depth projects such as: innovative forms of tele-learning and computerised lesson packages, stimulating interactive PC use and special simulations, and encouraging women to participate in BVEnet activities (both students and management).

ILCE

ILCE-related theoretical and research and development work

The ILCE system is inspired and takes after work in a variety of related fields. There is, for instance, a strong relationship with *Hypercourseware* when the focus is on learner control and the availability of a large knowledge base (see Mayes *et al.*, 1990; Thompson *et al.*, 1992). The focus on learner control also fits into the emerging educational technology trend to support independent learning at a distance (Ely, 1991, p. 46).

There is also a strong connection with (Intelligent) *Computer Assisted Instruction, Adaptive Learning Environments* (Jones, 1992) and *(Intelligent) Tutoring Systems* (McCalla, 1992) when the focus is on the adaptive qualities (Larkin and Chabay, 1992). Some authors still use the concept "individualising" to describe this feature (*e.g.*, Yang, 1990). The knowledge base -- basic content and embedded support devices (ESD) -- can be enriched with attributes, sometimes called the student model. The developers of the knowledge base graft these attributes upon the learning materials and indicate, for example, learning paths that take account of prior knowledge, study interests, professional orientation, etc. This "adaptation" feature of ILCE can be of a high level when the system tunes automatically the learning materials to the individual student after picking up specific values for student variables. Low level adaptation refers to the possibility for the student to select/arrange learning materials (basic content and/or ESD). The latter makes it for instance possible to compose "study modes" that automatically select specific sets of ESD in relation to selected basic content units.

There is also a likeness with "microworlds" and "interactive learning environments" as defined by Lawler (1987) when we concentrate on the active exploration and manipulation of a rich knowledge base.

ILCE resembles *Computer Managed Learning systems* and especially the emerging Interactive On-Line Advisory systems when we consider the "adaptive" possibilities of the system (Boyd and Mitchell, 1992). The latter authors describe for instance a system that helps students with the *what, how* and *when* of their learning. Learning plans are elaborated that take account of a student model, analogous to the "attributes" described above.

ILCE seem to incorporate and integrate basic features of this wide variety of instructional technology applications, thereby concentrating on the following functionalities: model based design of the learning materials, learner control, active manipulation of a rich knowledge base and adaptation to individual learners.

System and procedure prototypes

Up to six prototypes of subparts of the ILCE system have been developed. These prototypes have been used by a large research team, incorporating future users of the system: course authors, educationalists, system managers, tutors, course managers, domain experts, students, etc. At the same time, spin-offs of the project already resulted in "Electronic Workbooks"®, which have been developed for other universities, where independent learning is adopted as a major component in their educational design (Hermans *et al.*, 1995). At this moment a final system is available that will be commercially developed, distributed, maintained and updated.

Next to prototypes of systems also user-procedures have been developed and tested with future users. These prototype procedures are a necessary component to guarantee the future implementation of the ILCE as an innovative provision. Especially at the level of the developers of the learning materials major shifts in their current practice are needed. Therefore new user procedures and new organisational structures are needed. The R&D work in relation to ILCE exceeds therefore mere educational technology and/or information technology discussions. Strategic, organisational and economic discussions are of a comparable concern.

Evaluative results

Evaluative studies have been set up to validate design and development features of the ILCE system. The results can be summarised as follows:

The development system is sufficiently generic to elaborate repositories of learning materials for a wide variety of content domains. The positive impact of designing a course model is considered as a relevant activity; the supportive environment is highly appreciated by users.

The delivery system answers the flexibility and exploitation needs of the Ou-faculties and fits into the idea of flexible commercial exploitation of learning materials. Evaluative studies with prototypes of interactive viewers (interactive learning environments) indicate (1) the relevance of the possibility to adapt the provision of ESD to the needs of the students, (2) the positive impact of ESD-use and flexible manipulation on learning outcomes, (3) the relevance of the interactivity features in the learning environment (glossaries, browsing, user-control, history-logging, etc.).

Since the prototypes did also comprise prototype versions of user procedures, evaluation activities also focused on this important provision. The workshops with the actors have clearly indicated the need to adapt/change these procedures to be in line with the way these actors function. The iterative procedure in developing the ILCE system and user procedures has showed to be a justified development and research approach.

ILCE as part of a distance education training package

The use of the ILCE system implies that the designers and developers of the materials are acquainted with necessary knowledge and skills. The specific concepts and processes, such as elaborating embedded support devices, a learning path, building up a content model, etc., implie that the user is a professional in the field of distance education. The fact that the ILCE system explicitly asks for the application of this knowledge and the skills, makes the environment a powerful tool to be incorporated into a more general introduction and or training to/for distance education.

Depending on the needs of (national, international) partners, institutions or corporations that want to adopt a distance education approach to learning and training, a DE-training can be designed. Part of the training is -- of course -- realised with the ILCE environment; as a consequence the training can *e.g.* be studied on-line on a computer or be based on a printed version of the package developed. Several packages in English and Dutch are under development, but the tailoring to the needs of the client remains of importance. Therefore, the following random list of topics dealt with in the training is only a tentative one:

- definition of basic concepts in distance education;
- distance education and distance education materials;
- independent learning and the need for specific support;
- organising a context for independent learning and distance education;
- the choice of media types (text, audio, video, CAI, etc.);
- setting up development teams;
- setting up a DE-curriculum;
- the role of tutors;
- what are embedded support devices;
- integrating different media-types, etc.

The packages are designed as learning packages; they guarantee that the trainees actively make use of tools and produce real materials.

Conclusions and future developments

At an experimental level, the ILCE approach (prototypes and new procedures) has shown to be a valuable base to design, produce and study learning materials in a distance education context. The innovative ILCE approach is more and more adopted by Open University users. Although a final system is available, the actual design of the ILCE system is under continuous development. User specifications and demands influence the design of updated versions. The integration of telecommunication facilities is but one example of a recently realised extra facility which was tested at the university of Nijmegen. The Centre for Educational Technology and Innovation attempts to support the implementation of the ILCE system with evaluative research set-ups. This guarantees building up empirical evidence about the efficiency and effectiveness of the approach. But, even more important, it guarantees the continuous development and updating of the system and the distance education approach adopted.

APPENDIX

PROCESS CONTENTS	*PRIMARY PROCESS*	*SUPPORT PROCESS*	*ADMINISTRATIVE PROCESS*
TARGET GROUPS	• tele-learning for women reentering the workforce • tele-learning for more experienced entrepreneurs • network target group policy	• choice of school and vocation, apprenticeship system • choice of school and vocation, educational track • choice of school and vocation • diagnostic testing • traineeship database	• tele-forms • info-system for students in the hospitality sector • student pass for public transport • student financial aid
PROGRAMMES	• newspaper in the classroom • course in pesticides • programmes for apothecary and doctor's assistants	• training pass, Regional Employment Board district • comparing curricula • qualifications structure for agriculture • qualifications structure for hospitality sector • qualifications structure for adult education • qualifications structure for electronics • database of educational software teaching tools	• information about programmes
TECHNOLOGY	• tool box • handyscope	• assessment of interactive multimedia catalogue • groupware • multimedia database • test library	• campus-wide info • virtual Regional Training Centres

PROCESS CONTENTS	*PRIMARY PROCESS*	*SUPPORT PROCESS*	*ADMINISTRATIVE PROCESS*
LEARNING PROCESS	• tele-learning • remote classroom • learning environment • use of multimedia • office simulation • video learning	• Ou test-service system • electronic testing and conclusion • OVD testing and conclusion • EXIN electronic examinations • computer-aided teaching in the printing sector	• achievement database
INSTITUTION	• virtual Regional Training Centres	• from and for industrial sector groups • student reference library	• yellow quire • information on institutions • management info systems • GOAnet • info system on road and marine construction • BBS on BVEnet • vacancy database
MULTIPLE CONTENTS	• innovation database • teaching toolbox	• quality assurance	• policy info for vocational and adult education • information on projects • electronic sector trade • cyberspace at Regional Training Centres • hospitality sector facts & figures
TOTAL	17	24	20

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NEW ZEALAND -- TECHNOLOGY AND DEREGULATION

by
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The last ten years has been a decade of great excitement and anticipation for those seeking wider application of information technology to education. Each successive wave of technology has elicited ever more far reaching prophesies of their impact on traditional educational delivery systems. By the mid-1990s the possibilities do appear virtually boundless: the application of information technology should bring the unit costs of education down to a level that will allow most countries to keep up with the challenge of mass education; international communications networks should allow students to pursue programmes of study regardless of their location or that of the teaching system; and the magic of multimedia and telecommunications should finally break the stranglehold of the campus and the timetable delivering the control of education into the hands of the learner.

But this sense of excitement and anticipation is frequently marred by the daily frustration which IT specialists experience in their dealings with educational institutions. Everywhere institutional leaders express loud support for the application of new technology to the delivery of education. But the reality in terms of institutional commitment generally falls short of this rhetoric, and certainly well short of the vision of the IT specialists.

One answer to this challenge of the "implementation gap" is to write off the present educational systems and structures, and to start again with new systems and structures, purpose-built for the new technologies and the new challenges. Undoubtedly our traditional educational systems will find the challenge of the internationalisation of open learning, just to take one example, an extremely difficult one. It will be necessary to develop entirely new systems to meet such unprecedented challenges. But, I remain less convinced that the arrival of new technology will lead to the imminent collapse and replacement of traditional educational delivery systems as we have known them for the past century or so. More likely, existing institutions will continue to struggle with new technology. Their efforts will be goaded on by the competitive threat of the emerging, purpose-built, hi-technology agencies, and by the pressing demands of governmental and funding agencies for improved efficiency.

It is important for conferences such as this one to consider the kinds of new structures and international commitments that will be needed to take fullest advantage of emerging information technologies. But it is just as important to try to understand the ways in which existing systems and institutions can be assisted to apply these new technologies in appropriate and effective ways.

This institutional study of Massey University will explore the university's recent experience in developing and applying information technology to its educational mission. The experience of this particular institution is by no means unique. It is in the hope that these experiences will illuminate the efforts of other institutions and systems throughout the OECD group that the case study is developed and shared in this forum.

The national context

Over the past decade or so, New Zealand has moved from being one of the most highly regulated, protected, and interventionist economies in the western world, to one of the least regulated economies. The process started with the money market. After decades of attempting to peg our rate of exchange, the government acknowledged that we would have to accept the world's judgement on the value of our money and the strength of our economy. The dollar was floated and the financial markets were deregulated. A huge, well-buttressed structure of agricultural and manufacturing subsidies was next to go. Farmers screamed, land prices dropped, and much of our manufacturing industry started to disappear. The government then began the long march away from public ownership of major utilities and service organisations. Year after year familiar public institutions were down-sized, corporatised and finally sold off. The post office, the ports, the forests, telecommunications, large chunks of broadcasting, the national airline, the state bank, etc., the list continues to grow even in 1995. Along the way the labour market was deregulated allowing industry a much freer hand in the way it directs and rewards its labour force.

At the beginning of this process the changes were justified by the pragmatic argument that New Zealand was very near bankruptcy and had no alternative but to reduce its public expenditure. But increasingly, the ideology of the market and the individual were sufficient justification for what the government was doing. The rhetoric of the market provided an argument for every occasion. The claim is made that unless there is a strong public reason why services should be paid for by the taxpayer, the consumer of those services should pay more directly. Government will always be a less efficient provider of services than private enterprise, and wherever possible government should contract other agencies to deliver services rather than attempt to do so itself.

Public education has gone through its own radical restructuring. Most significantly the government has attempted to withdraw from being a direct provider of educational services. Instead it has devolved responsibility to the institutional level, and sought to render those institutions more directly accountable to their consumers, whether they be students, parents, local communities or industry groups. The government has attempted to develop a "level playing field" upon which state funded education institutions can compete for business and funding. The government, and its Ministry of Education, remain responsible for setting broad curriculum outcomes, for funding approved programmes and institutions, and for auditing performance against agreed standards.

In general, government has been consistent in its stance towards educational policy and provision. At a time when the declared policy of government is to reduce government expenditure from some 40 per cent of GDP to around 30 per cent, institutions are being forced to make increasingly difficult decisions about the funding and support of educational programmes. The government has little wish to re-involve itself in the management or delivery of educational services during a period of retrenchment. Only occasionally does an issue emerge which tempts the government or the ministry back into its old interventionist habits. The application of new technology to distance education and open learning has been such an issue.

In February 1992, Mr. Bolger, the Prime Minister of New Zealand, convened a one-day conference on "Education for Enterprise". The purpose of the day was to see how education could contribute to improving New Zealand's international competitive position. The conference coincided with the launch of the Australian Open Learning Project, and there was some interest expressed during the day about a similar initiative on our side of the Tasman. The Prime Minister made a commitment to the conference to explore further how telecommunications technologies might be put to better use for the development of interactive learning systems in a wide variety of educational and training systems. He stated at the time that perhaps through partnership ventures and coordinated effort the country might be able to make progress in this area more rapidly that if groups continued to work alone.

A few months later the Prime Minister's Department commissioned a scoping study to investigate and report on the application of telecommunications to open learning and distance education. A consortium comprising a telecommunications consultancy group, a management consultancy company, and educationalists and managers drawn from three separate institutions won the contract, and in due course produced a report.

The scoping study report reviewed the uses of telecommunications in the education system and made a number of predictions and recommendations for the future. These recommendations were both pragmatic and realistic. It made no sense, the report stated, to claim that any single communications medium offered a comprehensive solution to the challenge of providing open learning opportunities for New Zealanders. Each technology had its own distinctive contribution to make, its own appropriate area of application, and its own imperatives in terms of costs, development and training requirements. The report identified three broad technologies which were already finding a market and which needed to be supported and promoted:

- The first technology was teleconferencing -- enabling far-flung students to "assemble" in an electronic classroom and interact with audio, audiographic or video communications. Teleconferencing is probably the best medium for learning experiences which require the real-time interactivity of a classroom session.

- Broadcast television was the second medium which the report saw had an immediate future in New Zealand education. Television is a medium which everyone has access to at home; it can be used in real time, or at times to suit the learner through the use of videorecording; it offers attractive economies of scale with very low variable costs incurred for each additional student; and it is a medium which people accept, understand and enjoy.

- Computer mediated communications (CMC) was the third family of communications technologies for which the report saw an immediate future. CMC is different again from the previous two media. It can operate asynchronously from home which gives it two features in common with television and VCR, but also allows a high level of interactivity, albeit delayed, which gives it an important feature of teleconferencing. CMC allows students to communicate privately or publicly with their teacher, fellow students, or groups of students. It allows for study material or assignments to be transmitted; for students to access remote software and databases; and for teachers to engage their students in a sustained if leisurely dialogue.

The report maintained that these three technologies should be supported by the government, and that there was a place for a national initiative in each of them. Three pilot projects were mooted, in part to allow a more detailed analysis of comparative costs and benefits, but in part too as suggestions which government might choose to pick up and fund. The report suggested that government could play a role in piloting one or more of these applications, and then encourage provider institutions to come together with network or broadcasting organisations to mount larger projects. The report recognised that there was unlikely to be a significant injection of targeted funding from central government given government's funding policy and the severe constraints on public spending at present.

The government's initial response to the report was lukewarm at best. There may have been some initial disappointment that the report did not recommend the adoption and promotion of a single communications medium for distance education in New Zealand, but it appears to have accepted the report's findings that there is no single medium which would meet all the demands of distance education and open learning. The government may also have been hoping that the report would recommend a clawback of funding from existing distance education enrolments to concentrate on a single national telecommunications or broadcasting project. The major network and broadcasting companies were no doubt disappointed that the report had not favoured their particular pet projects, but on balance they seemed relieved that at least their competitors had not been singled out for favourable attention. And the major provider institutions had been encouraged to collaborate on communications projects, but not threatened with a compulsory clawback of funding to pay for them.

Over the past three years developments in the applications of technology to education in New Zealand have been very consistent with the predictions and recommendations of the report. Most significantly, we have seen collaboration between network organisations and educational providers in all three major technologies identified in the paper. The following are just a few examples of projects which the Ministry of Education has encouraged, or which have involved collaboration among providers and communication companies:

- The New Zealand Telelearning Network (NZTLN), a collaborative venture between Telecom New Zealand and a large number of regional educational institutions, is now soundly established. The network provides New Zealand-wide access to a selection of teleconferencing services which are available at a commercial rate to all educational users. The NZTLN has enabled a number of school-based and tertiary-level teleconferencing projects to get underway. Some of these projects have been seeded by the Ministry of Education, but the intention is that they will be funded eventually from normal institutional revenues. Some of the educational users rely on basic audioconferencing, but increasingly audiographics or video conferencing are being used.

- Television New Zealand (TVNZ) has offered an Educational Television service for four or five years. A consortium of educational institutions met regularly with TVNZ through the winter of 1992 to test the feasibility of a joint initiative in educational television. The outcome of those discussions, and the downstream consequences are discussed in more detail in the following case study.

- A number of institutions and organisations have been developing computer mediated communications services. Again, Telecoms New Zealand attempted to take a lead by establishing "New Zealand On Line", an educational CMC service intended to complement the synchronous communications services available through the New Zealand Telelearning Network.

- A fourth significant technology which the Scoping Study report paid too little attention to was the development of multimedia teaching materials. Here again, the Ministry of Education has funded a number of pilot projects to encourage educational institutions to develop courseware and gain experience with this medium.

But if this brief and selective list of developments provides an impression of co-ordinated development on a national basis, it would be an erroneous one. Government has made it clear that it will not be able to fund major new technological innovations, and that it remains ideologically opposed to usurping the decision making role of individual provider institutions. While the government has been able to fund some interesting and valuable pilot projects in the application of new technology, institutional managers have had to reach their own conclusions about whether to commit scarce resources to a full scale implementation. In general this has meant that progress has been slow and sometimes even halting. The New Zealand educational system is now a competitive one, and institutions are less willing to collaborate with one another on joint projects than they might once have been.

It is against this national policy context that educational institutions such as Massey University have developed their own policy and practice with respect to the application of new technology.

Case Study -- Massey University

Massey University is one of seven state universities in New Zealand. It is situated in Palmerston North, a provincial city located two hours drive north of Wellington, the national capital, with a smaller satellite campus at Albany in Auckland City. Massey University is a multifaculty institution with faculties of business studies, social sciences, humanities, information and mathematical sciences, science, technology, agricultural and horticultural sciences, and veterinary science. Massey has a student roll of some 25 000 comprising 8 000 mostly full time students studying on the two campuses, and another 17 000 mostly part time students studying "extramurally", or by distance education, from throughout New Zealand. Massey is New Zealand's largest university-level provider of distance education, and until recently enjoyed a virtual monopoly of this delivery system among the New Zealand university community. Even today the other universities offer only very modest sized distance programmes, and Massey continues to draw on students from one end of New Zealand to the other.

Massey is a classic "dual mode" distance education institution and similar in structure to many such institutions in Australia and Canada. The extramural programme is a mirror image of the conventional "internal" one. That is, all of the 750 courses taught extramurally by the university are also taught in the internal, campus-based mode. Most members of academic staff are required to teach their particular course simultaneously in each mode. They follow the same syllabus, employ the same instruments of assessment, and award identical credit, regardless of the mode.

Unlike most single mode distance education institutions, Massey adopts a relatively decentralised and devolved system of planning and development for its distance education programmes. Individual members of academic staff carry the major responsibility for planning and developing new distance courses and their associated study materials and delivery systems. They continue this high level of personal involvement by setting and marking all student assignment work and examinations, they organise and teach any residential or regional block course components, and they maintain direct personal contact with students by mail, telephone or other media. This model of distance education delivery closely parallels the high level of responsibility and autonomy academic staff normally enjoy in conventional campus-based teaching. A positive feature of this model is the strong personal commitment and enthusiasm which academic staff develop for their extramural teaching. The extramural programme is seen as equally important in their eyes as their campus-based classes, and does not suffer from the "Cinderella" syndrome so common in institutions with smaller distance education programmes. This high level of individual autonomy has its cost, however. Academic staff expect to remain in direct control over most aspects of the planning production and delivery of their particular course, and this will often prejudice their attitude to systems and media where that control must be shared or even surrendered to others. This point will become clearer in the following discussion of specific media.

Until a decade ago, the production and delivery options available for extramural teaching were strictly limited by principles of parsimony. All extramural courses were text-based. Academic staff would draft study notes and assemble collections of reprinted readings which would be prepared and reproduced on their behalf by a central extramural support agency. The great majority of courses would also require students to come on campus for two or three days each year for an intensive block course programme. Students would prepare and submit a number of assignments by post, and at the end of the year they would sit a formal examination at one of dozens of locations around the country.

At that time, about one third of all extramural courses incorporated one or more audiocassettes to supplement the printed material. A handful of courses also incorporated a videotape or two, a laboratory kit for some of the science or applied science subjects, or a telephone conference organised by one or two enthusiasts for that medium.

The remainder of this paper will be devoted to a discussion of the attempts over the past decade to incorporate new technology in the Massey extramural programme. It will be seen that the efforts Massey has taken tend to reflect the directions indicated by the scoping study report, even though some of these developments have proved inappropriate or unproductive. The discussion will touch lightly on the technologies themselves, but will focus on the matches or mismatches that were achieved between the technologies and the institution's mission.

Television

Television is hardly at the cutting edge of information technology any more. However, it still occupies a powerful place in the imagination of the public and of politicians, and institutional leaders need to understand it well if they are to avoid repeating each other's mistakes.

Ten years ago Massey University embarked on a major project aimed at augmenting its text-based distance education programmes by the use of broadcast television. A number of small, faculty-based video production units were amalgamated into a single, well-equipped television production unit intended to serve the whole campus. The primary purpose of the unit was to produce video teaching material to supplement the large-enrolment introductory-level distance education courses. This was to be broadcast, for a fee, by the national network in the early hours of the morning outside of normal broadcasting hours.

The project lasted for five years. Staff in the Television Production Unit worked alongside academic staff to produce video programmes to support around forty of the university's extramural courses. While the number of courses using television constituted only about 10 per cent of the total extramural offerings, the courses in question were those with the largest enrolments. The proportion of students exposed to educational television in any year would have been close to 50 per cent. Typically, a course would be supported by one, two or sometimes three twenty-minute videos broadcast at strategic intervals through the year. This relatively limited exposure to the medium meant that the videos could only ever supplement the text-based study materials. The producers attempted to concentrate on illustrative material, case studies, and aspects of the course that could not readily be conveyed by text alone.

From an educational viewpoint the project was a critical success. Most attempts to evaluate the impact of the videos found that students considered them helpful. They also enjoyed the additional exposure the medium gave to their teachers for in general teaching staff appeared in their own videos. The teaching staff themselves enjoyed the exposure to the new medium, though they frequently questioned the cost-effectiveness of their efforts. The only comprehensive survey that was undertaken of all targeted viewers was less reassuring. That study found that only about 40 per cent of students in the courses being targeted by television actually watched their programmes. The university had also proceeded into the project with the aim of achieving greater market visibility throughout New Zealand. While the programmes undoubtedly attracted their faithful viewers among insomniacs and early risers, they did not make a great impact on the general viewing audience.

What really counted against the project were its costs. In very broad terms, the annual cost of the project was some NZ $ 500 000 per annum. That sum accounted for most of the staffing costs of the production unit, the equipment depreciation and the broadcasting fees. While this sum is relatively modest in commercial broadcasting terms, it was a huge additional cost alongside some of the existing costs of servicing the extramural programme. At that time, this sum was close to the entire printing budget for the university's 400 extramural courses, and larger than the annual postal bill for the entire programme. Unfortunately, as is generally the case when introducing new technologies into education, these costs were additional and did not replace any existing services or costs. At first the university attempted to economise by reducing its production of new videos. But, finally, as government funding cuts were starting to bite in the early 1990s, the university suspended the project altogether.

After a two-year recess, Massey University made a second commitment to television in 1994. In the interval, Television New Zealand had itself become more interested in educational television. TVNZ began a daily broadcast of educational programmes and began to explore ways in which viewers could gain credit for their studies. During 1992 and 1993 a group of educational institutions met with TVNZ in order to determine whether there was a viable market for educational television in New Zealand, and whether there was a commercial future for a consortium of institutions to use the medium to support their teaching. The economic analysis did not look promising. It quickly became apparent that the market for television courses in New Zealand would be considerably smaller than the markets that have tended to sustain the medium elsewhere in the world. In fact it became clear that it would not be possible to recover the cost of producing educational television courses for the New Zealand market. Even when the costings were prepared on the assumption that existing "telecourses" would be imported from the international market, the economic outlook was marginal rather than rosy.

Nonetheless Massey University, as New Zealand's major distance university, considered it needed to give this new initiative a proper trial. In 1994 and again in 1995, two introductory-level courses in religious studies have been taught primarily by television. Employing the BBC series, "The Long Search", Massey has broadcast half an hour of television each week throughout the whole academic year. TVNZ has promoted the courses with generous use of screen advertising, and the enrolment process has been supported by a special 0800 telephone service.

Again, the use of television has been a critical academic success. Enrolments in the two courses virtually doubled in 1994 though they have slipped back a little in 1995. Surveys of enrolled students have indicated high levels of satisfaction with the courses, with the blend of text-based and television elements, and with the very high level of support provided by teaching staff. But again, the project is doomed by the same considerations of cost. The cost of the television component of the courses has been several times the cost of offering these courses in the conventional extramural mode. The revenue from a conventional distance education enrolment is used to meet the salary costs of tenured teachers as well as the production and servicing costs of the course itself. It is important to maintain this balance in a dual mode institution which wishes to maintain a commitment to research and scholarship as well as to teaching. Unfortunately, all the additional revenue accruing from television course enrolments was absorbed by broadcasting costs, leaving nothing for additional staffing or research. In an era when EFTS-based funding is strictly capped this becomes a questionable use for scarce funded places. So with regret the university is withdrawing from this second pilot project at the end of 1995.

TVNZ's experience with other New Zealand educational institutions is hardly more encouraging. One large Auckland-based polytechnic has offered a small number of introductory-level television courses in basic social science and business courses to a national audience for three years now. By its own claim, the programmes are meeting their costs -- just -- but there is little sign that the market is strong enough to encourage the institution to attempt to extend the programmes to more advanced levels. Two or three other major educational institutions have dipped their toes in the water as well and offered television courses on a one-off basis. But in each case they have not repeated the experiment.

Massey University has rediscovered what the rest of the world, and we ourselves, knew already: television is a medium that offers attractive economies if the scale is sufficiently large. If the size of the potential market is too small, the costs of broadcasting, let alone materials production, will be crippling. In theory, the market could be large enough to sustain a broad range of introductory-level television-based courses. If half a dozen of the larger New Zealand tertiary institutions collaborated on a shared programme of TV courses it should be possible for the programme to return a modest profit. However, in an environment where the government has insisted that educational institutions compete for market share, there is little incentive to cooperate.

At the time of writing, yet another educational television project is being launched. This one is being funded by the Ministry of Education, delivered by the New Zealand Correspondence School, and targeting up to 100 schools throughout New Zealand. Satellite transmission will be used instead of conventional broadcasting, and the project is intended to provide tuition in languages science and technology at the years 7-10 (ages 11-14). A measure of interactivity will be provided by encouraging students to phone or fax their tutors during and after the broadcasts. This project should overcome some of the timing problems associated with attempting to use broadcast media with a disparate and part time adult learning community. However, it remains to be seen how successfully the participating schools can adjust their own timetables to accommodate this new set of timetabling demands.

Teleconferencing

The great limitation of text-based distance education has always been its lack of interactivity. However well the course material is structured, it cannot meet the need of students to interact with their tutors and their class mates. Traditionally, Massey University has met this need for interactivity by scheduling campus-based block courses of two or three days duration in each semester. As the size of class enrolments has grown in recent years, many of these campus courses have given way to two-day courses held on successive weekends at three or four regional locations. These have allowed students to supplement their private study with two days of intensive interaction.

For over a decade teaching staff have been offered the alternative of conducting telephone conferences with their remote students instead of holding face-to-face campus or regional courses. Staff have been able to schedule two or three telephone conferences each semester with their students. Until the last two years Massey rented time on a national telephone conference network operated by Otago University, an institution operating a distance education programme relying heavily on this medium. More recently, we have used Telecom New Zealand's network services, either by direct link to students' homes or by using established teleconferencing nodes. Cost has not been an issue in the choice that teaching staff have made to adopt teleconferencing or to continue to schedule face-to-face block courses. But in spite of this fact, teleconferencing has never been a popular medium at Massey. In most years only seven or eight courses, from a total of 750 distance education courses, make use of teleconferencing.

There are a number of reasons for the relative neglect of teleconferencing as a medium. Most importantly, teleconferencing is a synchronous medium, and in most cases Massey University is working with an asynchronous market. That is, most of Massey's 17 000 extramural students are in full time employment, paid or otherwise. They elect to study by distance education because it enables them to fit their study round the other priorities in their lives, rather than fitting their lives around their study. Reading study material and writing assignments can be carried out at times that suit each student. The one-off weekend course can be planned for. What creates real difficulty is a regularly scheduled "encounter" such as a fortnightly or monthly teleconference session. Typically, any time a tutor schedules a real-time encounter such as this about half the enrolled extramural students are unable to attend. Once staff realise this fact they are most reluctant to devote time to teleconference sessions which may attract only a minority of their students. Almost as important as this first reason, many of our extramural students do not place as high a value on interaction with their class mates as the instructional designers would suggest. Many of our students are very confident, independent learners who want to engage with the subject material rather than with their fellow students, or sometimes even with their tutors.

This relative neglect of synchronous communications media in New Zealand distance education seems in contrast to the recent tradition of North American distance education. In New Zealand, most adult distance education students choose this mode of study because they are unable to meet the requirements of a weekly tutorial schedule, not because they live too far from a conventional educational institution or because they are unable to gain admission to such an institution. Given these circumstances, distance educational institutions need to be wary of re-imposing a schedule of timetabled tutorials on their students. In North America, by contrast, one of the great challenges of distance education is to expand educational opportunities to people living in more remote areas. A common and rational solution has been to link remote classrooms by one or other electronic means.

Another set of reasons for the relative neglect of teleconferencing at Massey University relate to the way academic staff like to teach and order their time. An appealing feature of extramural teaching at Massey is that it is asynchronous from the teacher's point of view as well as from the student's. They can prepare their study material, mark their students' assignments, and answer student letters at times that suit themselves, rather than at times dictated by a schedule. This is very important in a dual mode institution where academic staff are already required to meet the regular timetable of lectures and meeting commitments for a conventional, campus-based teaching programme. The requirement to conform to a second timetable of regular teleconference teaching sessions can be a source of resentment for staff whose work week is already tightly structured. When this factor is coupled with the inevitable stresses and strains of running an effective teaching session with up to a dozen different sites at once, it is hardly surprising that few staff take up the option.

There is another factor which teaching staff may be unaware of but which is seldom far from the considerations of managers. Teleconferencing has proved to be a relatively expensive medium. Recent analyses show that it is generally cheaper to fly a lecturer to regional centres on three successive weekends to offer a series of two-day block courses, than it is to run three or four hour-and-a-half long teleconference sessions which link up students in a dozen or more sites round New Zealand.

Videoconferencing has never been a practical option for most of Massey's extramural courses. All the previously mentioned drawbacks of telephone conferencing apply to video conferencing. But of course, the costs are considerably higher, and until very recently, the end-user hardware and facilities have not been available in close proximity to all our extramural students. For the past three years, Massey University has operated a video conference link between its main campus and its new campus at Albany in Auckland. But while the intended use was that of teaching, it tends to be used far more for administrative meetings and employment interviews at this stage.

Very recently teleconferencing has started to make a renewed impact on the extramural teaching programme, and the reasons for this development exemplify rather than contradict the foregoing analysis. During 1995 a number of principalship training courses have been offered using audiographics and telephone conferencing. Staff at Massey have linked up with groups of senior school teachers and principals on a regularly timetabled basis to conduct training and development sessions. The sessions have been very well received, and next year audiographics will be used to teach a number of graduate-level distance education programmes in management and technology education to groups of school principals and teachers.

These audiographic sessions have been successful because they have been an appropriate match of medium with market. These groups of principals and senior teachers have needed a synchronous, interactive medium. They are all able to get together straight after school, and all their schools have the required end-user hardware and software already. The courses have required principals to apply various strategies and approaches to their schools, and they have valued the opportunity to "meet" with their colleagues round the country on a regular basis to share their experiences. The success of these few applications of audiographics may encourage other teaching staff to incorporate this medium in their teaching. But it will be only in those courses which meet the following criteria: the subject is one where interaction among the students is necessary to the success of the learning experience; students are able to meet at regular times; students have convenient access to appropriate end-user equipment and facilities; and the student numbers are small enough to allow a significant amount of interaction in each session. These conditions may well apply in professional development programmes in nursing, management, social work as well as teacher education. They are less likely to apply in the large mainstream undergraduate classes in social sciences, humanities and business education.

Computer mediated communications

Almost a decade ago Massey University was piloting the use of computer mediated communications (CMC) in its extramural study programme. In the late 1980s several academics encouraged their extramural students to communicate with them and with each other by e-mail. They also conducted thematic discussions by e-mail with their students, encouraging them to use e-mail wherever possible to replace conventional mail.

Right from these early applications it was clear that CMC was, potentially at least, a very powerful and appropriate medium for Massey's extramural programme. It has been stated already that most extramural students prefer to communicate asynchronously with their tutors. Typically extramural students are studying part time, fitting their studies around the more pressing commitments of work and family life. While they may be able to free up five or ten hours each week for their studies, these hours are likely to be scattered through the week, and sometimes snatched at most antisocial hours. CMC allows students to communicate with their teachers and with their class mates at times that suit themselves rather than to a timetable determined by the institution.

Ever since those early pilot studies, CMC has been an important element in Massey's future planning. However, progress has been steady rather than dramatic over the intervening years. Massey University has been following a policy of using home-based communications technologies to support its extramural students wherever possible. Since 1988 all students enrolling extramurally for courses in information sciences and computing studies have been expected to have local access to a computer. Since that date the number of subjects for which students have required computer access has increased steadily.

In 1992 Massey University launched Mass-E-Mail, an electronic messaging system targeted at supporting extramural teaching and students. Initially the number of services available have been modest, with users being restricted to store-and-forward messaging and discussion groups. More recently the services have expanded to include on-line access to the library collection and the ability to send file attachments. As at 1995, only about twenty extramural courses make significant use of the system to deliver teaching or to support students' work, with just one course using the medium as its principal communications medium.

This has been a slow rate of take-up, but the university considers it is now well placed to take advantage of the recent explosion of interest in the Internet. Within a year or two we anticipate that we will discontinue supporting our own e-mail system, relying instead on commercial Internet gateways. By that time, the university will be able to offer extramural students full access to the services of the Campus Computer Network, and a growing number of extramural courses offering intensive CMC support or available on the World Wide Web.

Multimedia

Probably every large distance education institution in the OECD group of nations is grappling with the challenge of incorporating multimedia materials and CMC in their open learning programmes. For Massey University the challenges are economic, structural and educational.

Virtually all of Massey's 750 extramural courses are paper-based, providing students with anywhere from two or three hundred pages of printed material to well over a thousand pages. These sets of materials are authored almost exclusively by individual members of academic staff, or sometimes by small teams of academics. These same members of staff then teach the course to successive cohorts of distance students. This is a model of distance education with relatively low fixed costs in terms of initial materials preparation, and relatively high variable costs in terms of servicing each enrolled student. The economics of preparing multimedia-based teaching materials are quite different. The initial preparation costs are likely to be very high, while the variable costs involved with supporting each successive enrolment may be extremely low.

The challenge to institutions such as Massey University will be whether they can afford to produce their own multimedia study material at all. The conventional wisdom at present seems to be that there is no place for the development of small-scale, home-grown multimedia courseware, and that the huge development costs of multimedia can only be recovered by the growth of global markets for these products. This is a bleak prognosis for dual mode institutions such as Massey University, and seems to point to the emergence of international "super courses" which will force less sophisticated products off the market.

Up until a year or two ago development costs for producing multimedia materials were up to ten times the costs of preparing a typical set of print-based material at Massey. Multimedia experts were insisting that it was not possible to produce serviceable multimedia software without the contributions of instructional designers, graphic designers, information systems experts and marketers as well as content experts. Developments in multimedia authoring software, and growing experience in using that software now suggest that much smaller teams of developers are capable of producing very adequate courseware at a much lower cost than earlier projected. This will be essential if institutions such as Massey are to retain any significant involvement in multimedia courseware production.

The New Zealand domestic market is not large enough to support a full scale production studio approach to the development of multimedia courseware. Instead, Massey is encouraging selected groups of academics to develop their own courseware to determine whether there is an economic future for such home grown material. To date the results have been extremely promising. One of the strengths of a dual mode institution such as Massey is the large number of academics involved in the distance education programme, and the very wide range of subject areas they cover. This diversity is reflected in the first crop of multimedia software that is being developed. Massey offers New Zealand's only veterinary science programme, and staff have produced multimedia courseware on the subjects of excitable tissues, equine movement, and basic feline and canine physiology. In the Faculty of Agricultural and Horticultural Sciences a team is working on a full scale distance education course on soil science to be delivered on the World Wide Web. Another group are developing software to simulate factory production systems for courses offered by the Department of Production Technology. A further group is collaborating with an international team on the production of multimedia training materials for school management.

Infrastructural developments

When we think of the application of new technology to distance education we tend to focus on the development of electronic courseware and the use of telecommunications to link learners with teachers. Just as important are the many applications of new technology to institutional infrastructure which streamline existing services, or which make new services possible for the first time. Sometimes these developments may be invisible to the students themselves. Recent years have seen a number of key infrastructural developments in the Massey University extramural programme.

The most recent development has been the introduction of Interactive Voice Response (IVR) technology to allow students to access a range of information and support services by touch phone. Last year, student registration for the extramural programme was mail-based and batch-based. Students would submit a completed application form by mail. It would make its way through a series of batch-based processes culminating in a final confirmation of enrolment and the dispatch of their study material. This process took a minimum of two weeks, and in problem cases often considerably longer. This year, for the first time, students are able to complete their entire course registration in a five-minute telephone session with the Univoice IVR system. Further IVR applications are being planned. Students will be able to use the system to request course information material, to confirm assignment and examination results, to check and modify their credit status with the university, to register for residential and regional block courses, and to participate in surveys and elections. While none of these services relate directly to the education process itself, they will all improve the student's experience of the university.

Another background development that will make an important contribution to our use of new communications technologies is the move to electronic imaging in our printing processes. Currently the university printery prints 300 tonnes of paper each year for the extramural teaching programme. In the past the printery has been working from paper masters, albeit generated from DTP files. Electronic imaging is now allowing entire sets of study material to be scanned and then printed copy by copy rather than page by page. This development will allow us to print on a Just In Time basis in the future, reducing the investment in stock and virtually eliminating surplus stock. More importantly, the use of full electronic masters will allow students to access their study material by CD-ROM or CMC instead of by paper as at present.

A third development that is almost invisible to student users is the increasing sophistication and functionality of the management information systems used to handle the various administrative and support services operating on behalf of extramural students. One example will illustrate the point. Each year about 100 000 students assignments are posted in to tutors, marked, and then returned. Until five years ago all information concerning the dates of receipt and return and the grade allocated to each assignment, were recorded by hand on paper-based course lists. Today all assignments carry an electronic bar code to ease the recording of traffic information, and staff have access to a range of reports concerning the flow of assignments. It is now possible to monitor the turn round of assignments on a course by course basis, and to generate encouraging reminder messages to students who miss an assignment dead line. These are services that it was not possible to provide with the previous system, and they are already leading to better educational outcomes for students.

Where to now?

The development of computer mediated communications and multimedia offer the first realistic alternatives to paper-based correspondence teaching for Massey University and its distance education students. Over the next very few years the majority of extramural courses will be supported by a combination of synchronous and asynchronous computer based communications; many of them will deliver some or all of their course material in multimedia format, either by CD-ROM or by Internet; most student assignments will be submitted and returned by e-mail; greater use will be made of internationally available multimedia courseware, though most courses will continue to rely on locally developed material; students will have access to an expanding array of information and support services accessible by IVR telephony; and Massey will be offering its first courses by some variant of interactive pay television.

The prototype for such a blend of technologies is already being used by the Faculty of Technology to support its campus- and industry-based educational programmes. A series of Web pages are being used to deliver course material, to support on-line chat, to offer synchronous and asynchronous discussion groups, and to support the flow of student assignments. Progress is being made on the development of on-line assessment modules, computer simulations of industrial processes, and modules of interactive multimedia teaching material (this page can be inspected at URL:http://tef.massey.ac.nz/). A parallel development is being mounted by the Department of Soil Science (Url:http://www-aghort.massey.ac.nz/departs/soilsc/soilsc.htm). What is particularly promising about these developments is that they are located at a faculty or school level and are being developed directly by teaching staff with just a fraction of the resources that these media generally call for. These staff enjoy the same level of autonomy, flexibility and responsibility in their use of these new media for course development that they have enjoyed in their use of text and printing over the past three decades. This is a highly promising development for an institution such as Massey. Our particular strength as a distance education institution is our large, varied and committed body of academic staff. Computer mediated communications and multimedia development offer these staff the opportunity to remain at the centre of the distance education process rather than being relegated to the role of interpreter and mediator of imported courseware.

Conclusion

This paper has focused on the efforts that a New Zealand university is making to apply new technology to its ongoing mission of providing open and distance learning opportunities to adult students. These efforts are constrained and guided by the structure and culture of the institution, by existing commitments and programmes, and by the distinctive requirements of the institution and of its students. Progress in applying new technology has been selective and sometimes even slow. It has been suggested that many of the technologies on offer to distance education over the past couple of decades have been inappropriate to Massey's educational mission for one or more reasons. Some have costed themselves out of consideration; some have offered synchronous communication to a client group that is unable to commit itself to a regular weekly study schedule; some have demanded that academic staff submit to a production team approach to courseware development; some have made unrealistic demands on the time and commitment of teaching staff; and some have required end-user hardware that has been beyond the reach of most of our students. When students or staff have resisted these technologies this resistance has sometimes been misinterpreted as technophobia. I have attempted to argue here that this resistance has generally been a highly rational response to an inappropriate technology.

At the beginning of this paper I posed the question of whether conventional educational institutions would move fast enough in their uptake of new technology, or whether they will be outflanked by new purpose-built structures which will soon render them redundant. Like most simplistic dichotomies, it seems likely that neither situation will dominate. Undoubtedly, new open learning systems will evolve around the extraordinary capabilities of communications media. Both governments and multinational corporations will see these new structures as powerful vehicles in their quest for lower unit costs, increased student numbers and a healthy commercial return on investment. On the other hand, if conventional educational institutions can use new technology to enhance the educational experience of students both on and off campus, they are likely to remain the educational destination of choice for a great many would-be students.

This analysis has focused at the institutional level, at the decisions which a single institutions has taken over the past decade in its effort to apply appropriate technology to its educational mission. An important thrust of this conference is to explore the role of governments and multinationals in facilitating or even directing the take-up of new technology. We have already examined the ideological dilemma in which the New Zealand government finds itself in this respect. On the one hand the government is committed to a policy of devolved responsibility and competitive market conditions in the provision of public education. On the other hand, the government recognises the extraordinary promise of new technology for expanding access to education and reducing the unit costs of that provision. Faced with some hesitation among educational institutions in committing themselves to a new medium, or an unwillingness to co-operate in a venture which can only be undertaken efficiently on a national basis, there will always be calls for government intervention and government funding. Some people look across the Tasman to Australia and point to the intervention of central government in distance education over the past decade as an example we should be emulating in New Zealand. The attempted rationalisation of the provision of distance education to a handful of Distance Education Centres is one example; the funding of the Television Open Learning Project and the concentration of that project on a single major provider is a more recent one. Others believe that the government must play by the rules that it has drawn up. Government has established a level playing field and done its best to ensure that all the teams at the tournament are reasonably evenly matched. It must now settle down to the task of refereeing the game and resist the impulse to grab the ball and blunder up the field whenever it thinks that it could do better than one of the selected players. More specifically, calls for special funding and special initiatives to support this or that distance education initiative should be resisted. The funding for such new initiatives will not be new money. At best it will be money taken away from the competition to assist one's own project. More likely it will be funding pulled out of mainstream conventional or distance education to support a one-off initiative mounted by someone else. At least under the present rules institutions and communications companies are forced to plan very carefully before they commit themselves to new projects. They know that their own institutional livelihood is hanging on the accuracy of their estimates, and that the government is not going to bail them out if things get difficult.

On balance the "market" is working reasonably effectively to influence the application of new technology to education. Communications and broadcast companies have formed commercial relationships with educational institutions to support the provision of distance education opportunities where there has been a demonstrated market for these services. The communications industry in New Zealand is now one of the least deregulated in the world. This means that corporate players are able to make clear commercial decisions about their involvement in educational projects. Educational providers are forced to weigh up the relative merits of new technology against all the other claims on the institutional budget. While the prevailing model has been one of competition, institutions have collaborated with each other in the development and support of network services where it has been in their mutual interest. The government has played an important role in initiating and seeding pilot projects to trial a range of communications technologies, but it has refrained from taking the next step of forcing institutions to commit their own resources beyond the initial trial period. When there has been a demonstrated need for the application of new technology, and where the economic analysis makes sense, educational institutions and commercial enterprise have not been slow to make the commitment. Most New Zealanders are now comfortable with this system and are no longer looking to the government to intervene.

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NORWAY-- AN ELECTRONIC COLLEGE

by
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This report presents an overview of Norwegian learning technologies for adult education with specific reference to policies and activities on the educational use of the Internet. The case study will focus on NKI Electronic College which has offered a 10-course programme in Information Processing since 1987 through the EKKO computer conferencing system. EKKO philosophy has always been to provide education which is independent of time and space through a system that facilitates flexible communication for administrative, social, and teaching purposes.

On 1 January 1994, NKI introduced a new *open* electronic college as a further development of the EKKO system based on the philosophy that education should be as open as possible to other networks and services. The second generation system was accordingly based on Internet, e-mail, and the Listserv conferencing system. The second generation user-interface for modem users was initially text-based. The next step was to offer modem users graphic communication software developed for MS-Windows and the Serial Line Internet Protocol (SLIP): 22 different on-line courses are now offered every semester and more than 1 500 on-line course packages have been delivered.

The national context

Norway has approximately 4.3 million inhabitants. In 1995 approximately 160 000 students were enrolled in higher education institutions. The educational system is comprised of the primary school system (ages 7-16), secondary school system (ages 16-19) and higher education (universities and colleges). Adult education, continuing education and professional training officially have a central position through legislation, organisational structure, state funds and funds built up from agreements between labour and employment organisations.

Reform of the educational system

Higher education

Major reforms of the educational system have taken place in recent years. Tertiary education consists of four main universities and some 200 colleges of higher education. The 1994 higher education system reform caused some colleges and institutions to merge with universities and the remaining colleges into approximately 25 college centres. Increased quality of studies, rationalisation, and cost effectiveness rank among the top reasons for this reorganisation. One aim is for these new institutions to build on their respective strengths, become national centres for different subject and research areas, and develop into national forces in distance education.

Secondary education

During the 1994 reform, the secondary school system also underwent dramatic changes. The reform guarantees everyone between 17- and 19-years-old three years of secondary education in order to provide them with the competence needed for higher education studies or vocational competence as skilled workers. In principle, everyone choosing a practical-vocational stream should also have the opportunity to qualify for admission to higher education. Close co-operation between the school system and industry has been established to reach these goals. The normal route for vocational qualification will include two years in school and two years in industry (the last two years include one year training and one year production).

Adult education

Adult education is defined in different ways. This paper defines adult education as: training and education specifically directed towards the adult population (age 18 and above). In Norway, adult education is regulated by two specific acts: the Adult Education Act and the Folk High Schools Act. The following types of adult education courses are financed by national and local authorities:

- primary school education for adults;
- secondary school education for adults;
- labour-market training (education for unemployed); and
- education of adults speaking a foreign language.

The following types of adult education courses are financed through participation fees plus state grants:

- courses arranged by the study organisations;
- distance education courses; and
- Folk High School courses.

Three main categories of adult education (KUD, 1972) may generally be distinguished:

- Adult education aiming at examinations with parallels in the school system. This category covers the primary, lower-secondary, 9-year-school curriculum, upper-secondary, vocational and technical schools, and colleges and universities.
- Work-based adult education. It covers vocational training for adults as part of labour-market policy, training and education in business, trade and industry and education and training arranged by the labour organisations. Types of training involved include recurrent education, re-schooling and continuing education.

- Adult education not aiming at passing examinations.

Through legislation and funding, the Norwegian government has tried to distribute responsibilities for adult education between different parties -- private and public. The Adult Education Act covers the following areas:

- Studies arranged by the accredited organisations and institutions for study work.
- Courses at primary and secondary school level specifically organised for adults.
- Alternatively organised initial education for adults at all levels.
- Short courses and courses for upgrading at secondary schools, colleges and universities.
- Short courses for adults at the Folk High Schools.
- Vocational training for adults as part of labour-market policy.
- Education and training in business, trade and industry.
- Other education for adults based on specific decisions in each case.
- Distance education in accredited independent distance-education institutions.

Under the Adult Education Act, the state places the responsibility for planning, financing and organising different types of adult education on the state, counties, municipalities and public institutions at different levels, the liberal study organisations, and distance-teaching institutions. In addition to training and education regulated by the Adult Education Act, the National Broadcasting Corporation [Norsk Rikskringkasting (NRK)] has for many years been involved in adult education -- often in co-operation with distance-teaching institutions, universities, and study organisations.

Distance education

The keen governmental and political interest in distance education and telematics Norway is greatly due to the widely-distributed Norwegian population, large distances and a topography with mountains, fords and valleys. Some foreign-distance educators consider Norway "ideal for governmental support to *open* and distance learning". For instance, a German doctoral thesis on private distance education in 16 different countries around the world, showed that the relative number of distance students in Norway was more than the double that of the next country, Japan, more than three times higher than that of Sweden, and more than five times the relative number of students in non-governmental institutions in the United Kingdom. In the year of the study in 1977, there were 200 000 distance-course enrolments in Norway (*i.e.* 5 per cent of the population) (Karow, 1977).

Private distance education

Political interest in distance education made Norway the first country in the world to regulate private distance education by a separate act in 1948, which resulted in close government supervision of distance-education courses and institutions. In 1993 the Correspondence School Act of 1948 was repealed, and the regulation of activities of independent distance-education institutions were placed under the Adult Education Act. This reform has secured a better integration of distance education into the national adult education system.

Today there are approximately 20 distance-teaching institutions accredited by the Ministry of Education. The two largest, NKS Distance Education and NKI Distance Education, both non-profit foundations, claim about 80 per cent of yearly course enrolments. The total number of enrolments has decreased from the peak of 200 000 in 1976 to a little less than 100 000 in 1994. This decrease is probably principally a result of decreasing financial support from the state. Independent distance-teaching institutions developed their quality as a result of systematic evaluation and research over the last 20 years -- the last 10 years have seen a number of experiments on new media applications, specifically in co-operation with Norwegian Telecom (now Telenor).

Public distance education

Until recently distance education has been dominated by private initiatives. Following some governmental reports and white papers during the late 1980s, the government established the Executive Board for Distance Education at University and College Level (SOFF) in 1990 as a three-year project. SOFF was established as a permanent body in 1994.

SOFF's main objectives are to stimulate development and experiments in distance education at the tertiary level, co-ordinate activities, provide financial support, evaluate activities, and recommend potential future developments. The governmental initiatives through SOFF have stimulated universities and most colleges to become interested in distance education, and to establish separate posts and/or departments for distance education. Norwegian State initiatives in distance education at the tertiary level are often mentioned as examples of the systematic application of governmental policy to develop higher distance education towards clear goals of efficient resources use through co-ordination, co-operation and financial support. These initiatives are closely related to the other changes in the tertiary education system mentioned above. During its first three years SOFF provided financial support to more than 60 projects involving more than 60 different institutions and using a wide variety of technologies.

Co-operation

The Norwegian model of distance education is characterised by close co-operation. Distance-teaching institutions and study organisations have a long tradition of arranging so-called "combined education" -- combining distance teaching with local face-to-face teaching. For some projects, distance-education programmes have developed as a result of co-operation between distance-education institutions, study organisations, and the Norwegian Broadcasting Corporation (NRK).

The State Institution for Distance Education (NFU) was created to stimulate and co-ordinate distance-education projects, normally multi-media projects involving radio, television, video, printed textbooks, study guides, correspondence education and local classes. Partners in these projects include study organisations, distance-teaching institutions, colleges, universities, the NRK and publishers.

Research and development in distance education

Norway has a more than 20-year-long tradition in systematic R&D in distance-education. Projects have covered research on tutoring and student support, turn-around time, computer-mediated communication, audio and video communication technologies, survey studies, and formal evaluation projects. They were mainly initiated and carried out by research groups in independent distance-teaching institutions (SEFU, 1993).

For the last 10 years, the Norwegian Telecom Research (now Telenor Research) has been active in supporting and co-ordinating research in distance education, mainly through field experiments on new technology and communication media. These projects have specifically covered computer-mediated communication, video conferencing (point-to-point and multi-point), video telephone experiments, and satellite distribution (Kristiansen, 1993).

In recent years, some universities and colleges have become interested in distance education as a field of research, mainly as a result of the SOFF initiatives. A number of student theses on distance education have appeared and some academics have also entered the field. SOFF projects have clearly stimulated experiments and research on new technology in open and distance learning.

Applications of technology

Development is to some extent related to policy decisions at the state level and decisions to stimulate the development of distance education at the tertiary level and to define some specific institutions as centres for this development caused some institutions to build up organisational and technological infrastructures for the distribution of learning to the adult population. Some universities and colleges have built up video production units and technology for satellite distribution, while other institutions have made efforts to build up competence and technology for computer-mediated communication. The Ministry of Education has emphasised the development of a national infrastructure for electronic communication through Uninett -- the Norwegian academic branch of Internet.

Universities and colleges

Video

The Universities of Oslo and Bergen and the Lillehammer College (*Høgskolen i Lillehammer*) operate professional units for educational video production and produce videos for adult and distance-education programmes.

The University of Trondheim has some experience in offering courses based on video-taped lectures to industry. The so-called "Video-based group learning system" consists of video lessons and textbooks based on ordinary university courses supported by telephone consultations with instructors and group discussions at the participants' work place.

Tromsø College (*Høgskolen i Tromsø*) has made extensive use of video-taped lectures in decentralised part-time studies for nurses. NKI Engineering College (now the Polytechnic College) reports successful experiments in applying video-taped lessons combined with direct local teacher support in science and mathematics in decentralised studies. Lillehammer College has applied videotaped lectures in part-time distance education for teacher training.

Satellite distribution

The Universities of Bergen and Oslo and Stavanger College have some experience in satellite distribution. The University of Oslo has distributed lectures to a group of graduate students as part of upgrading teachers at a college for nurses and has transmitted satellite programmes for distance education institutions. The University of Bergen has transmitted satellite lectures as the main components of part-time distance courses in psychology. In connection with the upgrading of secondary school teachers, as part of the secondary school reform in 1994, the University of Bergen transmitted a few satellite programmes. Stavanger College (*Høgskolen i Stavanger*) has distributed advanced-training programmes in medicine aimed at a European public.

Computer-mediated communication

The University of Oslo has offered some courses by computer conferencing based on the PortaCom conferencing system and administered the system for other institutions that offer distance-education programmes. The University has also developed a World-Wide Web course about Internet services.[1]

Four colleges[2] and the University of Trondheim have co-operated to offer on-line courses under the auspices of the NITOL project.[3] In fall 1995, the programmes covered more than 40 courses. The majority of the students are full-time students at one of the co-operating colleges, but courses are open to external adult students who communicate via modems or local networks.

Video conferencing and video telephone

Norwegian Telecom has established a number of video conferencing studios around the country, especially in the north. Videoconferencing has been used to some extent in distance-education programmes offered by universities and colleges. In some cases, institutions of higher education have also experimented with video telephones to serve local groups in adult education. For some years Norwegian Telecom subsidised the application of video conferencing in distance education by offering free use of studios and very low communication fees. Videoconferencing facilities were used during this time to some degree. After these subsidies were withdrawn, however, the use of video conferencing in higher distance education decreased dramatically.

Secondary schools

Many local secondary schools take part in adult education, arranging vocational courses for skilled workers, or preparing for examinations in ordinary secondary school curricula. Secondary schools also co-operate with distance-teaching institutions by offering local face-to-face teaching.

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[1] Available in Norwegian at URL: http://www.uio.no/wwwfik/inter.html.

[2] Haugesund/Stord, Sør-Trøndelag, Agder, and Telemark.

[3] http://www.idb.hist.no/kurs/nitol/english/index.html.

These activities generally do not apply new technology. There are examples where video telephones were used to receive lectures from colleges or distance-education institutions.

Many schools in recent years have installed equipment to receive satellite transmissions. This equipment is in some cases used for adult education, such as distance education arranged by universities or independent distance-teaching institutions. Satellite transmissions have also been applied in connection with the in-service training of secondary-school teachers and the distribution of information about the 1994 school reform.

Local schools have co-operated to offer courses based on computer-mediated communication to expand student choice of subjects. These projects did not specifically aim to attract adults. Examples of the so-called project for "adult education in the armed forces" have offered secondary level courses to personnel via computer-mediated support from teachers in secondary schools.

Distance-teaching institutions

Distance education in Norway, as in most countries, was always based on printed materials as the most important technology. Norwegian independent distance-teaching institutions have nevertheless been the most active group in experimenting with new technology. These activities have to some extent been co-ordinated by the "Centre for Distance Education" (SEFU) since 1988.

Computer-mediated communication

In 1987, NKI Distance Education was the first Norwegian institution to experiment with computer conferencing in distance education. A proprietary conferencing system, EKKO, was developed to serve the needs of distance students. The experience has been described extensively both nationally and internationally (see Paulsen and Rekkedal, 1990; Paulsen, 1995). Other distance teaching institutions have followed these developments and included computer conferencing, usually as an "add on" to other distance-education communication forms.

Videotape programmes

Videotape has been used by distance-teaching institutions for some years. Videotape programmes might be an integrated part of programme packages or a supplementary offer to be purchased separately. NKS Distance Education has produced videos as part of their courses in the so-called "Open Secondary" which consists of a selection of courses preparing adults for secondary school examinations. NKI Distance Education has produced video lectures in basic subjects for the "Technical College" for adults. Video productions applied by distance-teaching institutions cover a range of programmes from expensive high-cost to very low-cost video, consisting of taped lectures.

Video conferencing

While distance-teaching institutions have been active in testing technology to support flexibility of open learning in order to enable the individual learner to choose where, when, and how to study, their interest in "time dependent" technologies such as video conferencing, video telephone, and satellite distribution has been much lower. Still, there are numerous examples of distance teaching programmes supported by satellite and video conferencing.

Study organisations

Study organisations play an important role in Norwegian adult education. They represent the local initiatives in organising adult education in all areas. The courses and programmes may aim at personal development or at formal exams in the state school system. Local study organisations co-operate with universities and colleges and distance-teaching institutions. Study organisations base their teaching more on traditional classroom teaching than on technology, though they do receive satellite programmes from a central organiser, such as a university or distance-teaching institution.

Telenor

Norwegian Telecom (Telenor) has financed research on communication technology in distance education, as well as taken part in such research. Telenor support also covers hardware development (such as video telephone), establishment of video conferencing studios, and provision of free communication lines for research.

Norwegian Broadcasting Corporation (NRK)

NRK has participated in many nationwide adult education programmes by supporting distance education based mainly on printed material and correspondence teaching. NRK has in recent years reserved television transmission time on early Saturday and Sunday mornings under the label The Learning Channel, which has accepted programmes produced by distance-teaching institutions, colleges and universities. NRK television is planning a second channel for 1996 where adult education television programmes will be scheduled for early evenings.

The State Institution for Distance Education (NFU)

In 1979, the government established NFU as an institution with the specific aim of developing adult education courses in co-operation with publishers, distance teaching institutions, NRK, and study organisations. Since then, NFU has co-ordinated the development of a large number of courses for different adult target groups based on a multi-media approach, normally containing correspondence courses, radio and television broadcasts, video cassettes, and local study groups.

Business and industry

Norway does not differ much from other countries concerning the use of technology for training in business and industry. Most training programmes are based on traditional media and methods with ordinary classroom teaching as the most important means for learning. However, in recent years multi-media (laser disk and CD-ROM) have also been chosen as means for learning. A first success was the Statoil development of a laser disk programme for safety training, which was developed to replace a two-day obligatory seminar for all off-shore personnel. The programme was successful because it reduced training costs by more than 40 million NOK over four years, and tests show significantly better learning in less time. These experiences have led other large companies, especially in the oil industry, to develop similar packages for important learning areas with large target groups.

Norwegian policy on the educational use of Internet

In September 1995, the Ministry of Education issued a strategic action plan for information technology in Norwegian education.[4] The aim was to urge all learners and teachers in the Norwegian educational system to become personal users of information technology. An important part of the strategic plan is to support a national Internet-based infrastructure providing affordable access to Internet for all educational institutions in Norway. The plan includes many initiatives to encourage primary and secondary schools to utilise Internet.

The Norwegian academic network (Uninett) links the universities, county colleges, research institutes, and private colleges. A growing number of primary and secondary schools have dial-in access to Uninett, which plays an important role in communication between collaborating colleges within the county college system and among colleges in the same academic field. Uninett is supporting a project to develop a national co-ordinated admission system, and a future national database for secondary-school report cards. The full cost of the network has so far been paid by the Ministry of Education. However, to make costs more transparent, invoices are to be issued to all member institutions as of January 1996. While the ministry will still meet the cost for most tertiary institutions, it will not cover the cost for primary schools, secondary schools, libraries, some private institutions, and modem users. There is a growing number of Internet providers in Norway and they can broadly be categorised in four groups:

- international providers such as Microsoft Network and Compuserve;
- national providers such as Telenor, Oslonett, and Powertech;
- Uninett Inc. serving the academic network; and
- private colleges such as NKI.

Case study -- The NKI Electronic College

Introduction

This case study reports on each of the two technological generations of NKI Electronic College. The first generation system, which was based on the EKKO computer conferencing system developed at NKI, was in operation from 1987 to 1993. The second generation, which is Internet-based, began in January 1994.

The first generation of NKI Electronic College proved its value through seven years of operation and 1 067 delivered course packages. 868 of these course packages were completed -- a completion rate of 81 per cent. About 45 of the first generation students have graduated from the Information Processing Programme, having completed a ten-course programme -- equivalent to one year's full-time study -- via computer conferencing. Students have obtained better grades than either correspondence or on-campus students. Surveys among the students show that they have a positive perception of the curriculum and the Electronic College itself. Student feedback also indicates that a teacher's way of handling communication is crucial to student perception of a course. Teachers are generally positive about the Electronic College and its opportunities; their main reservation is in regard to the heavy teacher workload introduced by the medium. This case study presents results from surveys of teachers, students, and administrators, as well as information about completion.

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[4] IT i norsk utdanning, Plan for 1996-99.

NKI

NKI is one of the largest non-governmental educational institutions in Norway, comprising Polytechnic College, NKI Distance Education, and NKI Publishing House.[5] NKI Distance Education offers 60 programmes and more than 250 courses, mainly in technical and vocational subjects. It has about 15 000 students and an extensive network of local partners around the country has been established to offer face-to-face classes to support distance students. Distance-education teachers are part-time employees recruited from business, industry, schools and colleges around the country.

The College of Computer Science (now incorporated in the Polytechnic College) was established in 1983. In addition to its ordinary two- and three-year full time programmes, it offers a two-year, part-time programme in information processing, emphasising programming and system analysis. This part-time programme is offered in three modes: face-to-face classes, correspondence courses, and the Electronic College. The Electronic College is designed so that distance students can do all their communication on-line. In contrast, many of the internationally renowned implementations of "electronic colleges" are actually using computer conferencing as a supplement to correspondence courses or on-campus teaching.

The first generation: 1987-1993

The idea of the NKI Electronic College was conceived in 1985 and further developed through research on existing computer conferencing systems such as PortaCom, EIES, and CoSy, and on electronic colleges such as Connected Education and the Western Behavioural Sciences Institute (Paulsen, 1989*a*). In the first two years, the project was propelled by a handful of enthusiasts who devoted much of their spare time to the project. The idea was to use computers to support flexible interpersonal communication in distance education with students, faculty, and staff communicating independently of time and space through the college's central computer and exchanging written messages both individually and in groups (Figure 1).

The Electronic College needed administrative and logistical support from NKI Distance Education, and academic and technical support from the College of Computer Science. At first, few believed in the project, making it hard to acquire the necessary support and to integrate the project into NKI organisation. Gradually, the Electronic College thrived, receiving both national and international recognition. By the spring of 1992, it sold about 800 courses, but the administration routines needed to be further developed.

The first version of EKKO -- the Computer Conferencing Software hosting the electronic college -- was designed and implemented in 1986. The system was used for the first time, as an optional supplement to on-campus teaching, in fall 1986. The first attempt to deliver a distance-education course via EKKO was done during fall 1987. Two additional courses were introduced the following semester. Since spring 1990, the college has offered all ten courses in the Information

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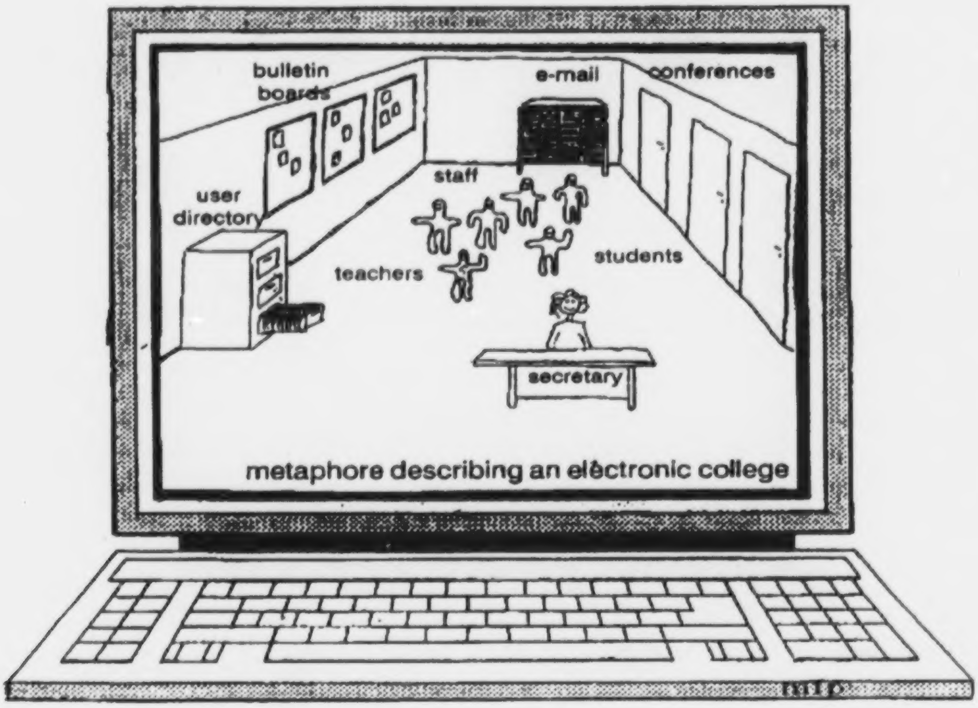
[5] A further presentation of NKI is available at URL: http://www.nki.no.

Processing Programme every semester. These ten courses constitute the equivalent of a one-year, full-time programme.

Figure 1. **The 1st generation system metaphor**


bulletin boards
e-mail
conferences
user directory
staff
teachers
students
secretary
metaphore describing an electronic college
mip

Participants

In the spring semester 1991, the student completion rate for all courses was 71 per cent (Table 1). The enrolment figures for each year depend on the time when enrolment information was gathered. In the few weeks before and after courses start, students frequently add or drop courses. The statistics for non-starters have not been gathered, but observation indicates that many of the drop-outs were non-starters -- they did not complete any of the assignments.

A 1988 demographic survey of students (Paulsen, 1989*b*, pp. 33-35) showed that the respondents were between 19 and 62 years old and that there was a substantial majority were men. A large majority of the students were married or cohabiting and had children. Even though most of the students lived in the greater Oslo area, many came from other parts of the country. The respondents were well educated (several were teachers and engineers). Students were also relatively advanced computer users.

Table 1. **Numbers of students enrolling/completing courses each semester from the fall (F) of 1987 to the spring (S) of 1992**

Courses	F87	S88	F88	S89	F89	S90	F90	S91	F91	S92
Intro. to Comp. Sci.	4/2	22/16	6/4	12/7	33/24	10/5	21/11	5/4	22/?	8/?
Pascal Programming		19/9	7/4	9/4	23/15	26/20	22/10	7/6	24/?	15/?
Info. Sys. I		16/10	8/5	12/4	33/23	20/15	23/12	8/5	25/?	12/?
Intro. Bus. Adm.				7/2	3/2	2/2	17/14	3/2	7/?	9/?
COBOL Programming				3/1	4/4	12/11	9/8	7/7	5/?	11/?
Relational Databases					4/3	18/16	13/12	9/5	12/?	5/?
Information Sys. II						20/17	12/11	20/13	12/?	15/?
Mgmt. Info. Sys.						5/5	4/4	20/18	4/?	8/?
Socio-Tech. Sys. D.						4/4	5/5	17/15	5/?	8/?
Project Assignment					1/1	3/2	0/0	12/10	4/?	8/?
Totals	**4/2**	**57/35**	**21/13**	**43/18**	**101/72**	**120/97**	**126/87**	**108/85**	**120/?**	**97/?**

Needs Assessment

The computer boom in the second half of the 1980s propelled the demand for computer courses. However, no formal needs assessment for the Electronic College was conducted. How can one assess the need for concepts which neither the consumers nor the providers comprehend? The Electronic College was obviously technology driven, promoted by people with a vision of a future medium for distance education.

Staff

The number of people involved with the Electronic College increased as the project developed. The project administrator has been its only full-time employee. During the 1st generation, about 20 part-time teachers were engaged to teach courses. Some have taught just one course once, others have taught two courses each semester for several semesters. The rest of the project manpower has been provided on a part-time basis by NKI staff. The most important services were provided by the EKKO system operator, who handles operation of hardware and software as well as user support, and the course secretary, who handles enrolment and fees. Other important services provided by NKI Distance Education are course development, logistics, and examinations. The extent of services provided by NKI Distance Education varied from semester to semester, but can be estimated to be equivalent to one or two full-time employees.

Content

The Information Processing Programme emphasises information processing, programming, and systems analysis. Its goal, stated in the programme handbook, is:

> "The programme is primarily developed for users of computers and software applications. Responsibility for using computers is increasingly transferred to individual users, so there is a need for people who can assume responsibility for local computer applications. These people need -- in addition to their ordinary job skills -- enough knowledge about using computers to understand the opportunities they provide, and to participate in the implementation of computer projects. The programme provides knowledge about the opportunities which computers offer. Students develop knowledge about information processing, allowing them to take part in systems analysis and development as well as programming. They will be able to develop small-scale information systems and modify existing systems. It is essential that they apply these skills in their work environment (NKI, 1991, p. 4)."

Finances

Public schools, colleges, and universities generally charge no tuition fees in Norway. The non-governmental NKI has to compete with public colleges in this unfavourable financial environment. The Electronic College was therefore developed under economic constraints. There were limited grants to support the project, and it was necessary to settle on pragmatic, low-cost solutions which were seldom optimal for the new medium. Two important economical resources were student fees and research grants from the Norwegian Ministry of Education and Norwegian Telecom. During the first five years, the research grants totalled about US$ 100 000.

The Electronic College fee structure developed over several semesters. For the first and third semester, each course was priced at the rate of the equivalent course taught by conventional correspondence education. It was decided that courses offered the second semester should be free (the students only paid for textbooks) in order to encourage student enrolment so the college could gain experience with larger classes. By offering free courses, the college received positive and free media exposure for the, until then, esoteric concept "electronic distance education". For the fourth semester a US$ 25 (NOK 150) communication fee per course was introduced. The communication fee was converted to a US$ 150 (NOK 1 000) semester fee for the fifth semester. The college stated that the communication and semester fee would cover the use of EKKO and all data communication costs except local telephone charges.

The course fee has varied from course to course, increasing at a rate slightly higher than inflation. It ranged from approximately US$ 300 to US$ 500 per course, and covers tuition and textbooks. Students must pay an extra US$ 100 if they want to take course examinations. As an incentive to complete courses, students receive about US $50 refund -- payable towards another course -- for each course completed, which is financed through the state fund system for private distance education.

Facilities

- The workstation

The college does not require students to use any specific brand of microcomputer, modem, or communication programme. The only requirement is that they can upload and download ASCII files via EKKO. The school does not provide or rent any equipment to the students, and the schools logistic workload is consequently greatly reduced.

- Communication lines

Since spring 1988, the following data on communication lines are documented:

EKKO was logged on continuously, and use varied from student to student. Among students who completed one or more courses, the number of log-ins varied from once a week to several times a day. The minimum number of log-ins during the semester was 11, the average was about 80 and the maximum number was 350.

We had two Public Telephone and Telegraph (PTT) lines for 300 Bps modems and two autodetect PTT lines for 1200 and 2400 Bps modems. We also had six Public Data Network (PDN) channels. These lines were available, not only for our distance students, but also for other users.

The communication lines were used at almost any hour of the day. The peak frequency occurred during the afternoon and evening and the frequency dropped to a minimum at night.

Our four PTT lines and six PDN channels seem to have had the capacity to handle all our users during our experiments carried out so far.

We paid for the student use of the PDN. In 1988, the fixed PDN cost was US$ 293 and our variable cost for each of the 57 courses was US$ 22 on an average (Paulsen and Rekkedal, 1990, pp. 72-75).

User support

Since the Electronic College had few resources to spend on user support, marketing and user support focused primarily on students who could readily master the communication system with minimal help from the college. The limited user support available was geared towards production and distribution of user manuals and communication software. Students could also request help over the telephone during work hours and pose questions in EKKO.

Organisation of user groups, conferences, and bulletin boards

EKKO serves at most about 3 000 users and many different user groups including on-campus, prospective, present, and former students, teachers, and administrative staff. Table 2 gives a schematic overview of how EKKO is organised to serve these user groups and their different needs.

Prospective students seek information about the college, the curriculum, and the conferencing system. They need access to sufficient information to decide whether to apply for a course. If they decide to apply, they should be able to apply and register on-line. To reduce labour-intensive counselling of prospective students, the college has given them necessary access-privileges to search for information themselves. They have access to the Curriculum board, the User Manual board, and the Published Articles board. Everyone in Norway has free access to EKKO. The college continuously announces how to access EKKO, so prospective students can become acquainted with the system -- providing such access might be the programme's most valuable marketing activity.

Table 2. **Some important user groups and their access privileges to EKKO conferences and bulletin boards**

Conferences/ bulletin boards students	Prosp. students	Present students	Former	Teachers	Staff
Curriculum board	RO	RO	RO	RO	RW
User manual board	RO	RO	RO	RO	RW
Published articles	RO	RO	RO	RO	RW
Admission office	N	N	N	RO	RW
Faculty club	N	N	N	RW	RW
Admin. board	RO	RO	RO	RO	RW
Exam board	N	RO	N	RO	RW
Course boards	N	RO	N	RW	RO
Course conferences	N	RW	N	RW	RW
Cafe conference	N	RW	RW	RW	RW
Presentation board	N	RW	N	RW	RW

N = No access, RO = Read Only access, RW= Read and Write access

Current students need tutoring, administrative information, and social recreation and it is necessary to organise a suitable infra-structure for these purposes. The college has established course conferences and course boards for tutoring, a "Cafe conference" for social activities, a Presentation board where students can introduce themselves, and Administrative and Exam boards for administrative and examination announcements. Some former students may want to know when new courses are offered, others want to stay in touch with old peers. The college has given them access-privileges to stay on-line without any charges, hoping that continued access may develop an important alumni network.

Each teacher has a course board for distribution of information to classes. Each also moderates a course conference. All teachers can access any course board or conference to pick up pedagogical ideas and approaches. The Faculty Club is set up for discussion of administrative and pedagogical issues. The staff is responsible for distributing administrative information. EKKO provides a Curriculum board, which is an "electronic copy" of the printed programme handbook. The User Manual board is an on-line version of the paper back manual. Published articles and papers, describing distance education projects, are issued in the Published Articles board. The Administrative board holds information about registration fees, and application deadlines. Selected examples of former examinations are presented on the Exam board.

Students may order a course via e-mail, phone, or land-mail. The programme secretary informs the System Operator and the teachers via the Admission Office board whenever students enrol in courses. The System Operator then grants the students the appropriate access-privileges and teachers welcome them.

Teaching

EKKO courses are based on textbooks and curricula developed for corresponding face-to-face courses. All courses include a study guide originally developed for correspondence courses. Developers of study guides have become more and more aware of the fact that these guides are also used by EKKO students. Most courses are based on six compulsory assignments. EKKO teachers have occasionally substituted alternative assignments in order to experiment with other pedagogical techniques. Students can send their work by e-mail to the teacher, or in note form in class conferences.

To create group cohesiveness and to support student collaboration, it is necessary that students in each course progress at roughly the same pace. The college therefore applies fixed dates for the beginning of a course and for the final examination each semester. This policy contrasts that of correspondence courses, in which students may enrol at any time. Since the courses are based on correspondence which have been adapted to the new medium, they may be criticised as being electronic-correspondence courses. The following examples should refute these allegations.

Projects

The Project Assignment Course, taught during the spring semester 1991, was carried out according to the following learning plan. The course work involved collecting information, through interviews and a literature search. An important goal was to familiarise students with project management and co-operation. A second main objective was to teach students how to produce a written report of project results. Students were encouraged to find a project related to knowledge obtained through the Information Processing Programme and to their jobs. They were asked to form project groups of one, two, or three students. Each student received two textbooks through land-mail. In addition to the textbooks, the students received a fifteen-page study-guide that was developed for both correspondence students and EKKO students. The guide included extra guidance for distance students, course requirements, and assignments. Since the study-guide was completed shortly after the course began, it was distributed via EKKO.

Twelve students, ten men and two women, enrolled in the course which, for most of them, was the 10th and final course in the programme. By this time they had all become advanced computer conferencing users, with no need for user support. Most of them had enrolled in more than one course in the spring semester 1991. The course started the first week of February 1991; the final project report was due 10 May. During this period students had to complete four assignments. The first covered textbook theory. Each student had to turn in a short essay via e-mail. Students were also asked to present project ideas in the class conference. For the second, students had to form a project-group and present their task, milestone plan, and responsibility chart. The third asked each group to write a progress report from its project, and the fourth required the final project report.

The teacher's role was to comment on the assignments and help students whenever they had questions about projects and project management tools. Most of this feedback was routed via e-mail to each specific group, but information of general interest was posted on the class bulletin boards, or in the class conference.

Role play

In fall 1988, one teacher taught "Information Systems 1" via EKKO. In a class conference she presented a case that described a company planning to invest in a new computer-based office automation system. Students were assigned roles as user, accounting officer, project manager, and labour union representative. Over a period of about fourteen days, students were to elucidate the different facets of the case by enacting the different roles.

Peer critique

In "Management Information", the teacher practised a technique by which students presented results of their individual assignments in a small group conference. The students' peers were then asked to critique the work.

Multiple-choice database

Another teacher used the EKKO on-line multiple-choice database described by Quale (1990) as part of "Introduction to Computer Science", for the first time in the fall of 1989. Students could first download a number of multiple choice questions, then figure out and later upload the answers for scoring by the database.

Programming

Beginning in fall 1988, a teacher taught programming courses for several semesters. In the Pascal course, students used Turbo Pascal to develop programmes on their home microcomputers. The programme source code was posted to the instructor, or shared with the other students in the conferencing system. In this way the teacher and the students could download the programmes, modify them if they so chose, and then execute them on their local computers. The COBOL course allowed students access to the host computer's COBOL compiler. Although this method was inconvenient, [illegible] functional. The important lesson was that distance students can access host computer applic[illegible] compilers, database systems, and statistics software.

Grades

Grades are exclusively based on results of the final four-hour essay examinations. EKKO students, correspondence students, and on-campus students take the same tests at the same time at several sites around the country. Results show that EKKO students achieve better grades than either correspondence students or on-campus students. On a scale of 1.0 (best grade) through 4.0 (lowest pass grade) to 6.0 (lowest fail grade), Table 3 presents the total average grades from fall 1989 to spring 1991.

Three factors may explain these differences in grades. First, EKKO students seem to enter the courses with better general background than do on-campus and correspondence students. Second, EKKO students have more compulsory assignments than do on-campus students. Third, the communication form forces EKKO students to write more than on-campus students must write. This necessity probably provides EKKO students an advantage since it better prepares them for the typical four hour essay-style exam (see Appendix 1).

Table 3. **Total average grades**

Student group	Mean grade	N	Semesters
EKKO	2.57	288	fall 89 to Spring 91
Correspondence	3.05	125	fall 89 to Spring 91
On-campus	2.89	889	fall 89 to Fall 90

Feedback from teachers

Paulsen summed up the teaching experiences of the seminal spring 1987 semester in three points (translated from Paulsen, 1989*b*, p. 17):

- My main impression is that we did not manage to use the opportunities to create a class cohesiveness. I believe this is because there were too few students in the class [four students] and because they did not have a synchronous course progression.
- The teaching was mainly an electronic version of a traditional correspondence course. The response time was shorter than is usual in correspondence courses, which I perceived as an advantage. I had, though, to experiment to find an effective way to comment on the students' assignments.
- The students had obvious problems in learning how to use a modem. As a teacher, I would like to have a support service that could help students solve these problems.

By spring 1988, there were more students in the classes, the course progress was synchronised, and student support had improved. Two of the teachers wrote extensive reports about their teaching experiences. Their reports, which are available in Norwegian (Paulsen, 1989*b*, pp. 118-139), showed that:

It had been an interesting and work-intensive teaching method. Their work could have been more efficient had EKKO been better adapted to teacher needs. Teaching will be less work-intensive the next time the courses are offered because many of the text files can be used again (*op. cit.*, p. 45).

In fall 1988, all the material from the previous semester was made available to new teachers in order to reduce their workload. Some changes in EKKO software were also implemented to make teachers' work more efficient. Three teachers were interviewed about their teaching experiences during the fall 1988 semester (*op. cit.*, pp. 48-50):

> "They were pleased with the opportunity to work when it was convenient, and disturbed by the fact that it was hard to initiate communication in class. They stated that the instructor's workload was large, but that it would decrease when the courses were repeated. Pedagogical techniques that stimulate dialogue between the students are needed. The teachers believed that courses that rely heavily on graphical representations are not suited for this kind of teaching"(*op. cit.*, pp. 52-53).

The problems associated with sending and receiving graphic files in EKKO were handled by quasi keyboard-graphics, fax, or land-mail. Later, an updated version of EKKO was developed to handle uploading and downloading of graphics and other binary files. One teacher described his teaching experiences in the Pascal and COBOL courses in 1988-89:

> "I logged-on to EKKO twice a day as long as I was in the vicinity of my PC. I received the information in a file and logged-off the system. Then, I wrote my comments, logged-on again, and dispatched my comment files.
>
> Students' notes and my corresponding comments were filed in the student directories. I established one directory for each student. The comments were identified with references to the assignment and question number. I believe it is important that the comments are written in a "friendly way". Emotions are hard to express in this medium, and they are easily misunderstood. One should have this in mind when one reads student contributions.
>
> The workload is heavy when one teaches such a course for the first time. One needs a lot of notes and files compiled in a system" (Børsum, 1990, p. 108).

Another teacher, who taught "Introduction to Computer Science", reported that:

- the course "Introduction to Computer Science" is suitable for electronic distance education;
- effective use of EKKO can to a large degree simulate a classroom; and
- EKKO-base is a valuable tool (Lindland, 1990, p. 124).

Four teachers responded to a 13-item questionnaire about teacher experiences during the fall 1988 semester (Paulsen and Rekkedal, 1990, pp. 89-103). Their comments include details about the specific courses, how the courses were taught, and how they could be improved. All four agreed that the workload was heavy.

Feedback from students

There was no organised survey of the four students' opinions in the fall 1987 semester. The following student statement is however documented:

> "Generally, I evaluate the scheme very favourably. It is right on target to offer a system pairing correspondence courses and evening classes. One may compare it with "combined courses", a combination of correspondence courses and lectures, which I have favourable experiences with from high-school courses. In my opinion, it is wonderful not to have to attend five-hour lectures twice a week after work" (Paulsen, 1989*b*, p. 17).

In the spring 1988 semester, questionnaires were distributed to forty students. Twenty-eight were completed and returned. The results were summarised as follows:

In most cases, students gave a positive overall assessment of this form of distance education. None of the students were dissatisfied with the course. On a scale of 5 = very good to 1 = very poor, their average estimate of the courses was 3.9, 4.3 and 3.9.

The two main reasons for being interested in the course were the subject matter and communication medium. Our distance students had a relatively good grounding in the use of computers and computer science prior to taking EKKO courses. Most of them, but not all, already had experience with word processing and/or a PC/micro-computer. However, there were remarkably few who had experience with modems and/or conferencing systems before starting the course. The 1 200 Bps users were mostly satisfied with the transmission speed, but the 300 Bps users were not. In general, students were satisfied with the lines of communication. The PTT users were little disturbed by noise, but the problems increased with speed. The PDN users claimed to be more disturbed by noise on the lines.

Most of our distance students live in the Oslo area, although other parts of the country were also represented. Our distance education courses have attracted students with a good educational background and a wide variety of vocations. A great majority of the students are married or cohabit, and have children but there were significantly more men than women among the students.

The text books and assignments for submission were developed for traditional correspondence courses. The students, by a large majority, felt that this had not hindered them in their learning. It is therefore possible to offer instruction without materials specially developed for courses of this kind.

The students reported that the tutors' individual responses to their assignments, and the chance to communicate with the tutor via e-mail, was very important to them. They were satisfied with tutor response time.

The instruction was planned with fixed deadlines for submission of assignments, in order to create a co-ordinated progression through the courses. This was found helpful by both students and teachers, but all those who failed to complete claimed that lack of time was the main reason. The deadlines for submission of assignments should not have appeared as frequent as every second week.

The main reasons for not signing up for the exam were lack of time or lack of interest in formal accreditation (Paulsen, 1990*a*, p. 239).

One student's evaluation of the Pascal course is documented from the fall 1988 semester. At the end of the report, the student states: "The electronic distance education developed to become a sort of electronic correspondence teaching" (Paulsen, 1989*b*, p. 48). On the basis of a comprehensive telephone interview with 20 EKKO students, 26 correspondence students, and 20 prospective EKKO students, Rekkedal (1990) concludes:

> "Experiences from the spring term 1989 semester, along with previous experiences (and new data obtained in the fall term 1989) have shown that distance education through the EKKO computer conferencing system has functioned quite well."

The NKI Information Processing Programmes can now be studied in 4 different ways: full-time and part-time on campus, correspondence studies and electronic distance studies. These alternatives seem to reach different target groups, thus giving study opportunities for prospective students with different needs. Correspondence studies and electronic distance studies seem today to attract different student groups, who deliberately choose their preferred method.

There is need for better information to prospective students, on what electronic study involves in technological problems and costs. Lack of modems and familiarity with technology involved is still a major barrier for recruitment to electronic distance studies. There is a need to make communication commands and procedures easier for novice users.

We also see a great need to develop theoretical frameworks and methodological experiments to find appropriate teaching methods and learning techniques for particular subjects, types of objectives, content and evaluation procedures.

Research is needed to find teaching methods which stimulate meaningful course-related and social communication. It is important in this field to develop teaching styles which stimulate active student contribution and since teaching through computer-mediated communication seems to be extremely demanding and time-consuming, it is essential to develop procedures which make it cost-efficient (Rekkedal, 1990, p. 103).

The responses from twelve students from the fall 1989 semester were analysed and documented (Paulsen and Rekkedal, 1990, pp. 52-54). The following is the final paragraph of the report that was returned to the students:

> "I am pleased to note that most of the comments I received relate to teaching and learning. Very few comments report technical problems, even though we know that they still exist. I consider this a demonstration that we can concentrate in the future on important issues, namely quality education."

An e-mail interview with graduated students was conducted in 1991. Unfortunately only five students responded. They were asked the following question: What is your opinion of the NKI Electronic College, now that you have finished all ten courses? The complete set of answers are included in Appendix 2. The answers showed that the respondents were very positive about the freedom provided by the Electronic College and about the programme contents. They also point out that teacher activity is of crucial importance to students' perception of a course. This is indicated by these two comments:

> "Some of the teachers should have been more active in trying to 'drag the students into the conference'. What I think is a problem (...) is that there are some teachers who are taking this job as a 'secondary job' and consider it as a secondary job. They are not interested in answering questions in the conference, just in giving us exercises and in correcting our written work. It sometimes made me quite frustrated, when I put a question into the conference and I didn't get the answer until the date for delivering my exercise was there".

> "In my opinion, teachers are the most important part of the programme. They should always be very active and sensitive to questions posed by students. The differences between the various courses was considerable. A teacher who continually monitors the activity and who responds promptly is a prerequisite for an effective programme with motivated students. Some teachers have been terrific, others rather slack" (see Appendix 2).

Administrative feedback

The programme secretary indicated that:

> "EKKO is a very efficient communication medium. Information and orders can be executed much faster than via ordinary mail. As long as EKKO students are not registered in the existing computer systems developed for our correspondence students, it is difficult to do administrative work. Much time and work can be saved when the EKKO students can be registered automatically" (Paulsen, 1989*b*, p. 53).

Since then, much work has been done to make the administrative work more efficient. However, there is room for improvement of both manual and automatic routines. A discussion of possible future administrative applications within EKKO is presented in Paulsen (1990*b*, pp. 110-112).

The second generation: starting 1994

Even though the first generation of the NKI Electronic College was in many ways a success, it had to introduce a new system when the old host computer was retired. With the aim of developing an improved second generation system, a critical review of the first generation system revealed that the system should:

- be based on standard software;
- provide access to Internet;
- not be subject to internal rivalry between departments favouring specific solutions;
- be accessible from every computer network within the NKI organisation;

- be inviting to potential collaborative partners; and
- be more user-friendly.

New courses and programmes

The second generation system stimulated the development of a number of new courses and programmes. First, technology itself and the public demand for Internet access resulted in the development of the two courses: "Introduction to Internet" and "Designing World Wide Web Presentations". These courses were first offered in the spring of 1995 (Table 4). Second, NKI introduced the two information technology programmes Information Networks and Document Administration.

- Pacing

One important aspect of these courses that differs from those in the Information Processing Programme is that students may enrol at any time and are allowed individual pacing. There are two reasons for this. First, NKI expects to enrol more students because enrolment is no longer limited to the beginning of each semester. Second, in a survey among EKKO students on study barriers and recruitment, Rekkedal (1990, p. 92) concludes that:

> "it is a major challenge to develop methods and organisations in distance education based on computer conferencing systems which take care of the distance students' need for autonomy and flexibility".

Table 4. **New on-line courses introduced by the NKI Electronic College in 1995**

Individual courses
- Introduction to Internet
- Designing world-wide Web presentations

The Information Networks Programme
- Internet
- Data communication
- Network Management
- Multimedia Networks

The Document Administration Programme
- Word-processing, spreadsheets, and database tools
- Organisational theory and management
- English on Internet
- Document administration

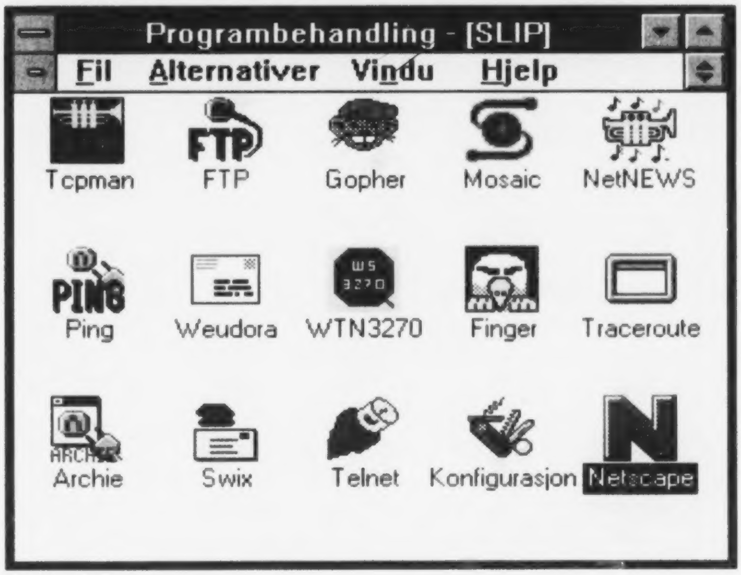
The second generation system

For the second generation system, NKI decided on Internet focusing on serial line Internet protocol (SLIP), e-mail and ListProcessor, a UNIX version of the Listserv conferencing system. The system is based on e-mail because:

- E-mail is by far the most used CMC application. Hence, it is the application with the most intriguing market potential.
- All departments and offices of NKI have e-mail access. Using e-mail prevents internal system rivalry between NKI departments. It is of further importance that a substantial number of NKI employees are frequent users of e-mail.
- An accelerating number of companies are installing e-mail. Consequently, an increasing number of prospective students may communicate with the college from work. These students need little training because the teaching takes place via their everyday e-mail system.
- Experiences show that potential external collaborators are apprehensive of collaboration schemes that make them too dependant on the system provider.
- E-mail is an international service that enables NKI to reach an international market.

To provide e-mail and Internet access via modem, NKI introduced a SLIP service that included a Windows-based user interface such as the one presented in Figure 2.

Figure 2. **The software provided to SLIP users**


Programbehandling - [SLIP]
Fil
Alternativer
Vindu
Hjelp
Tcpman
FTP
Gopher
Mosaic
NetNEWS
Ping
Weudora
WTN3270
Finger
Traceroute
Archie
Swix
Telnet
Konfigurasjon
Netscape

- Listserv

NKI installed ListProcessor 6.0a, a UNIX version of Listserv. The software offers an advanced e-mail distribution system. The system could be explained as a conferencing system based on e-mail. Such systems can support more users than any other conferencing system because they communicate with the system via e-mail. In addition, there are thousands of Listserv installations and tens of thousands of Listserv lists around the world from which e-mail users can benefit. Listserv consists mainly of three components: distribution lists, archives, and a command interpreter.

- Distribution lists

The distribution lists disperse e-mail to all subscribers of the addressed list. E-mail to the list Ekro (the electronic cafe) will be distributed as e-mail to each individual subscriber of that particular list. Listserv can manage many lists and each list can be configured individually as open or closed. E-kro is for instance open to everyone who would like to join, while lists established for classes are closed, that is, open only to students who register for that particular class. Listserv can further be configured as one-to-many lists and many-to-many lists. Andrea, an electronic newsletter for European distance educators, is configured as a one-to-many list, allowing only the list-owner to post to the list. Norweave, an international list for friends of Norway, is configured as a many-to-many list allowing all subscribers to post. Table 5 shows some examples of lists organised by NKI.

Table 5. **Examples of English and Norwegian language lists**

Lists in English

- Andrea: Open, one-to-many list for European distance educators
- Norwaves: Open, one-to-many list for distribution of "News from Norway"
- Norweave: Open, many-to-many list for "International friends of Norway"
- Nec: Open, one-to-many list for distribution of information about international NKI courses

Lists in Norwegian

- Neh: Open, one-to-many list for distribution of information about the NKI Electronic College
- Adm: Open, one-to-many list for distribution of administrative messages to students
- E-kro: Open, many-to-many list for social communication
- Gdb: Closed, many-to-many list for the course Introduction to Computer Science
- Pas: Closed, many-to-many list for the course Pascal
- Cob: Closed, many-to-many list for the course COBOL
- Sys1: Closed, many-to-many list for the course Information Systems I
- Sys2: Closed, many-to-many list for the course Information Systems II
- Bed: Closed, many-to-many list for the course Introduction to Business Administration
- Rdb: Closed, many-to-many list for the course Database Systems
- Anv: Closed, many-to-many list for the course Management Information Systems
- Pso: Closed, many-to-many list for the course Socio-Technical System Development
- Sem: Closed, many-to-many list for the course Project Assignment

Listserv is a distributed system, installed on thousands of computers that altogether organise tens of thousands of lists. NKI students can therefore benefit from these lists in addition to the lists organised by NKI. Two examples of such lists which may be of interest to distance educators are the two electronic journals Deosnews[6] and the On-line Chronicle of Distance Education.[7]

- Archives

The archives enable e-mail users to retrieve archived files from the system. The archived files comprise information files stored by the system managers and chronological copies of e-mail messages distributed via distribution lists. In this way, archives are utilised for holding copies of user manuals, and course descriptions, as well as discourses.

- Command interpreter

The command interpreter processes commands included in e-mail messages and returns corresponding responses via e-mail. Some command examples are included in Table 6.

- Open international lists

Most of the lists at the NKI Open Electronic College are closed lists dedicated to students enrolled in courses. The system does include however some open lists that could be of interest to international distance educators.

Table 6. **Examples of some Listserv commands**

- help: returns an overview of user commands
- help me: returns an overview of help files
- subscribe Andrea Your Name: subscription command for the list Andrea
- unsubscribe Andrea: unsubscription command for the list Andrea
- review Andrea: returns a list of subscriber names and e-mail addresses for the list Andrea
- information Andrea: returns information about the list Andrea
- lists: returns an overview of all lists at the NKI Electronic College
- index Norwaves: returns an overview of files in the Norwaves archive
- index -all: returns an overview of all files in all archives
- get Norwaves vol2.num34: returns volume 2 number 34 of the Norwaves electronic journal
- search Norwaves Statoil: returns a list of files in the Norwaves archive that include the search word Statoil
- which: returns an overview of lists that the user subscribe to

In September 1994, NKI established Andrea (A Network for Distance Education Reporting from European Activities) in co-operation with EDEN (European Distance Education Network). The aim of Andrea is to distribute information and facilitate communication among European distance educators. This means that Andrea welcomes information on distance education in general with main emphasis on information from European organisations and information from other parts of the world of specific interest to Europe. It welcomes contributions and participation from European organisations such as EADTU, AECS, SATURN, Europace 2000 and others. Andrea has also established contact with different national distance education organisations in Europe to supply information on national activities to people in Europe. NKI hopes that Andrea will develop into a major source of information for European distance educators and others interested in distance education and related fields in Europe.Norwaves distributes weekly news about Norway in English. The service was established in March 1993 by four students at the NKI College of Computer Science. After one year of operation, Norwaves was distributed to about 1 000 people in more than 25 countries. The news has been provided by the Norwegian Information Service, Norinform and by The Royal Ministry of Foreign Affairs. A typical issue of Norwaves includes ten pages of news from the previous week.

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[6] Listserv@psuvm.psu.edu.

[7] Listserv@alpha.acast.nova.edu.

Norweave is a moderated forum for Norwegians and friends of Norway who want to establish contacts in Norway and abroad. Norweave, which has several hundred subscribers, is a moderated list. It was established in September 1993 as a supplementary service to Norwaves. The network is also meant to provide mutual help and support as well as to share information of interest to the Norwegian community.[8]

List administration

Each list is managed by a list owner via e-mail. Andrea, for example, is managed via e-mail from Iceland and Norweave is managed from California, United States. Much List-owner work deals with subscription service and user support. In these moderated lists, the list-owner is the only one who is allowed to post to the list, so that the list-owner has some editorial responsibility screening incoming messages and soliciting quality information for distribution. The decentralised management of Listserv lists accommodates collaboration between geographically separated providers of distance education. In this way several smaller organisations together can form an electronic college.

Some second generation observations

The first semester was marked by transition to the second generation system. Students, faculty, staff, and system operators had to learn and adjust to the new system. The *open* system introduced additional problems regarding e-mail transmission of national characters and binary files. This is due to lack of standard interpretations among e-mail systems.

Some students have e-mail addresses prior to enrolment, but the majority of students must be provided with NKI e-mail addresses. With the increasing number of e-mail users, NKI expects that a growing number of students will have e-mail addresses prior to enrolment. NKI has enrolled a few Norwegian students living abroad and also ventured to offer courses internationally. The experiences show that it is possible, but that the administration and logistics of such courses would not be trivial.

Students have access to Internet resources outside the NKI realm. Some students report that they use these possibilities, and research should be conducted on how these services are used and how they benefit students. Since inexpensive access to Internet is provided with the courses, some students deliberately delay study progression to maintain Internet access.

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[8] Further information on Norwaves is available at http://www.nki.no/~morten/norwaves.html.

APPENDICES -- EVALUATIVE EVIDENCE

Appendix 1: Examination results, fall 1989-spring 1991

Most of the exams were prepared by teachers who taught face-to-face. The grades are presented as averages, because averages are automatically computed by the administrative software. On a scale from 1.0 (best grade) through 4.0 (lowest pass grade) to 6.0 (lowest fail grade), the students achieved the following grades:

	Average grades				Number of students				Number of students failed			
	F89	S90	F90	S90	F89	S90	F90	S91	F89	S90	F90	S91
EKKO students												
1	2.58	3.17	3.10	2.40	18	3	10	5	0	0	2	0
2	2.66	2.50	3.00	2.75	22	3	13	4	1	0	2	0
3	2.38	2.47	2.70	1.33	12	16	10	6	1	1	1	0
4		2.50	2.65	2.45		18	10	11		0	0	0
5	2.00	2.60	2.44	2.00	4	10	9	7	0	0	0	0
6	2.50	2.75	2.64	3.25	2	2	14	2	0	0	0	1
7	2.00	2.93	2.83	2.70	3	14	12	5	0	3	0	0
8		2.60	2.00	2.43		5	3	14		0	0	0
9		2.75	2.60	2.38		4	5	12		0	0	0
All	2.50	2.64	2.75	2.34	61	75	86	66	2	4	5	1
Correspondence students												
1	3.80	3.69	2.96	3.30	5	13	14	10	1	1	1	2
2	2.70	3.27	3.25	2.54	5	11	8	13	0	2	1	0
3	2.25	3.17	3.45	3.05	6	3	10	10	0	1	3	2
4		2.50					2					0
5		3.50	1.75	3.50		2	2	1		0	0	0
6	2.50	2.50	3.00	2.17	4	2	1	3	0	0	0	0
7												
8												
9												
All	2.80	3.40	3.07	2.88	20	31	37	37	1	4	5	4

On-campus students

1	2.69	4.53	2.69	61	3	56	6	2	4
2	2.95	2.50	2.72	55	2	39	6	0	1
3	3.48	3.86	3.35	54	8	58	18	3	12
4		2.61			71			5	
5		3.43			60			17	
6	2.74	2.75	3.04	68	2	54	6	0	11
7	2.59	2.94	3.05	73	20	32	3	0	7
8		2.63			85			1	
9	2.69	2.68			71	17		2	1
All	2.86	2.86	2.96	311	322	256	39	30	36

1 = Intro. to Computer Science
2 = Information Systems I
3 = Pascal Programming
4 = Information Systems II
5 = COBOL Programming
6 = Intro. to Business Administration
7 = Relational Databases
8 = Management Information Systems
9 = Socio-Technical Systems Development

The grades for the Project Assignment course were passed/failed.

Appendix 2: Graduate opinions

Question: What is your opinion of the NKI Electronic College, now that you have graduated?

Solfrid Grøndahl:

"I feel this is a difficult question for me to answer, though I have been a student at this college for nearly 2 ½ years. First of all I want to say that I am grateful for the possibility this college has given me to take higher education without having to leave my house.

I also feel that the different courses and text-books (all printed material) are of rather high quality, and most of it is written in a language that makes it quite easy to understand. This is important, because being a student at this Electronic College, is a rather lonely way of studying. Of course you have the possibility to ask the teacher questions, but this will cover only small parts of the curriculum. You will have to read, study and understand most of it by yourself.

To get through, you need great self-discipline, because the studies take most of your spare-time. There is not much time left for your family and other social activities. It is of course easier studying at an ordinary school, because a great deal of the curriculum is explained to you, but I think you learn and remember better when you have to study everything by yourself. Some teachers have given me a lot of supplementary documents on the subject, and these have been of great help to me.

The fixed dates for delivering written work is of great help, because it forces you to work 'all the time'. The conferences created for those taking the same subject is a good idea, even if I feel they didn't serve the purpose they where thought to have. Some teachers should have been more active in 'inviting students into the conference'. What I think is a problem for NKI is that some teachers taking this as a 'secondary job' and consider it in this way. They are not interested in answering questions in the conference, just in assigning exercises and in correcting written work. It sometimes frustrated me when I posed a question during conferences and didn't receive an answer until the due date for the exercise.

Because I have been a rather active student, I have many new friends all over the country. I like this way of studying, first of all because I don't need to leave my house. However, you must do most of the studies on your own, so it's a difficult path (...)."

Finn Kylland:

"I have a very positive impression of an electronic college. With modern data-communication technology, it is much easier to transfer information than with people. An electronic college can offer students a combination of flexibility, freedom, and efficient teaching, which is unattainable in traditional schools. With this in mind, Norway should offer electronic college programmes at least as widely as traditional college/university programmes."

Ole Salomonsen:

"Using EKKO, I was able to study while I lived 500 kilometres away from the nearest college. EKKO has substantial advantages compared to information exchange via mail -- especially the swift feedback on assignments. Technically, EKKO has worked almost perfectly for me. I had some problems adapting my communication software, but it worked well after a while. I used Procomm Plus/Galink/Telix for communication.

Taking part in education as a distance/part-time student suited me perfectly. I could not pursue continuing education without moving, for instance to Oslo, with all the problems that would entail for my family. Neither would I be able to keep up with the technological development at my work place."

Eva Reppen:

"I think NKI's electronic Information Processing Programme offers an excellent way of studying. I live in a rural area and worked full time while studying. I had no other opportunity than to follow this programme for continuing education in information processing.

Electronic programmes are obviously the solution of today. First, it doesn't matter where you live. Second, the communication between the school and the student can be swift. Finally, you experience a cohesiveness with other students so that you don't feel as if you are studying alone. Personally, I appreciated rigid dead-lines. In that way, I had to work hard, even though it has often been tough to hang on. In my opinion, the teachers are the most important part of the programme. They should always be very active and sensitive to questions posed by students. In this regard, the differences between the various courses has been considerable. A teacher who continually monitors the activity and who responds promptly is a prerequisite for an effective programme with motivated students. Some teachers were terrific, others were not.

It is possible that I will register for more courses if I find something of interest. Since I have tried electronic distance education, I am unlikely to ever again register for a correspondence programme -- I have become too selective. There is a tremendous difference between these two methods of studying. I recommend the programme to others and have already found you another student from my county. Maybe I can find some more in the future."

Stein Korten:

"As a student at NKI Electronic College, I am not required to attend lectures two or three days a week. With a demanding job and two small children at home, I have obviously little spare time. So, the NKI Electronic College suits me perfectly. I can study when it is convenient without being dependent on teachers and co-students. I am also very pleased with the curriculum. A broad range of topics is included. One may start to cover the basic concepts and then progress as one prefers. The only thing I miss is the opportunity to choose certain subjects for in-depth study."

Appendix 3: The distance education course for distance tutors

Since 1978, NKI Distance Education has trained its tutors through a distance education programme in the didactics of distance education. The training programme was originally developed as a correspondence course for tutors. This course was later adapted for used in tutor training in all Norwegian accredited distance-teaching institutions. It has also been published in English as one module in the Diploma Programme in Distance Education organised by the Association for European Correspondence Schools.

Since 1988, it has been adapted to on-line distribution and has since then been offered as one of the courses of the Electronic College, both during the first generation based on the EKKO system and since January 1994 through e-mail via Internet.

The course consists of a textbook with an integrated study guide, a specific guide on practical principles of distance tutoring and counselling with reference to different subjects, a specific course within the participant's subject area and two authentic student assignments. The course consists of three mandatory assignments. Since participants can enrol at any time and progress at their own pace it is difficult to engage the students in group communication. Communication consists mainly of written introductions and one-to-one communication between tutor and individual participants. A major part of participant time is given to the study of texts, analysis of learning material for distance education and authentic student answers, and essay writing based on assignments for submission.

Feedback from participants has been very positive. Although the course was developed primarily to give an introduction to the principles and practices of distance tutoring to prospective tutors without previous teaching training or experience, participants with teaching experience and/or previous studies in education seem to be very satisfied with both the form and content of courses. As a result of offering tutor training for distance education via the Electronic College, NKI builds up a staff of active or prospective tutors with competence in tutoring on-line and experience from studying via Internet.

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SPAIN -- EDUCATION IN RURAL COMMUNITIES

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The national context

The continuous training of adults is one of Spain's greatest targets. In this developed and competitive environment, updating the knowledge of those involved in the productive sectors is highly necessary, and implies the continuous revision of methodology at all levels: in the statutory education system, in vocational training, in university studies, in the research sector and in the education of adults.

Spain is a very large country compared to its European neighbours, with 504 000 km², only France is larger, with 547 050 km². Spanish geography, on the other hand, is much more unfavourable than that of most European countries, since it is the most mountainous and has the largest desert region. Spanish population -- 36 million inhabitants, the fourth in Europe -- is concentrated on coastal areas and in the large cities, making the distribution of population highly uneven. As a result, there are many areas in Spain where the offer for adult education is very poor, in spite of modern highways and means of communication.

Under these conditions, information and communication technologies are needed to fill a gap of great importance and have a promising future. The development of distance-learning and teaching using such means -- especially information technologies and telematics -- is inciting much interest all over Europe, and fits perfectly Spanish necessities. Training for unemployed workers and those in work has received special attention by the authorities of the National Institute of Employment of the Spanish Work Ministry. This kind of action usually involves face-to-face courses, concentrated in a given time, and held in centres or institutions which co-operate with the ministry. However, in 1990 the Mentor Project was created by the Ministry of Education and Science aimed at establishing a structure able to offer training which would put an end to space and time limits.

The project set its own limits on experimentation and environment: teaching has had to take place mainly using technological means (computers, VCRs, telematics), it is personalised and interactive, using only telematic tutors, and is accessible to all (by means of technologically-equipped classrooms, well attended and geographically distributed). Once the strategy was chosen, it was necessary to create the materials for the courses, because -- apart from some commercial software -- there were no suitable materials available and they had to be created, especially books, videos, exercises in software media and, above all, the software for telematic tutorials and the methodology of the courses.

At that time, the infrastructure and technology situation suggested the use of non-integrated multimedia materials: using packs made up of videos, software and printed materials rather than integrated multimedia support (which became the trend of the project in 1995). On the other hand the IBERTEX network -- Spanish videotext -- was adopted, to provide the telematic media. This network possesses the advantage of its even cost (and its low cost: 12 pta./min., or $6 per hour), distance independent and accessible from any place furnished with a telephone. Its drawbacks are the poverty of the user's interface and the low speed of data transmission: 1200/75 Bps. in 1990, 2400/2400 Bps. immediately thereafter. The present trend of the project is to use INTERNET at 28.800 Bps., and ISDN (64Kb), where available.

The origins of the project go back to 1990. Initial financing was obtained in 1991 through FEDER (European funds for regional infrastructures and development) and the first enrolled students started their activities in May 1993. In this period all decision-making took place: studies on viability, development of materials, setting up the servers, design and implantation of information technology to meet the problems, negotiations with local authorities, training of classroom administrators and tele-tutors, and designing and setting up the mechanism and routine for the running of the classrooms in the different towns.

Case Study -- The Mentor Project's objectives

Objectives

The Mentor Project was developed to explore distance-training environments based upon information technologies, audio-visual and telematics. The main objective was to spread distance-training -- open, flexible and non-statutory -- to the people living in areas where formative opportunities are scarce. At the same time, it aimed to encourage local development in co-operation with other institutions. From the methodological and technological viewpoint, the main question that the project would like to answer is whether distance-training is possible by the exclusive use of these means, without face-to-face training.

The New Technologies Programme has not attempted to make widespread use of the results, which would be the competence of other sections of the Ministry of Education and other ministries. Eighteen towns were initially chosen and the experiment was aimed at a large number of students (about 1 500 in the first phase), with the aim to obtain enough representative data to draw conclusions and introduce improvements from the very beginning.

Feasibility study

A typically rural area (Castilla y León) was chosen, and within the area the selected towns were neither very small nor very big: between 2 000 and 25 000 inhabitants. The capital towns of the provinces were not included, because in these places face-to-face training courses were highly concentrated. The individualised process of negotiation with town mayors followed, in order to involve them in the project. Local education authorities in the provinces which represent the Ministry of Education were also involved.

Research into the training needs of young people and adults was carried out in the selected towns. Once these needs were identified, priorities and proposals for course content were formulated, to be developed by the Mentor Project. As a result, the following courses were set up:

- Management of small and middle-sized enterprises
- Accountancy module
- Buying and selling module
- General electronics
- Health education
- Rural tourism
- Desktop publishing
- Leisure and audio-visual media
- Computer-aided design
- Introduction to C language
- Programming with Clipper language
- Introduction to information technologies

Student profiles

The sociological characteristics of the typical student, after the 1 500 registrations, correspond to an unemployed woman between 20 and 25 with vocational-training studies, an insignificant previous knowledge of the subjects they wish to learn. The courses offered are considered by the students as oriented towards increasing the qualification of unemployed people, and the presence of students and housewives must be emphasised. It is also necessary to point out the importance given to professional updating, as stressed mainly by the male sector. Thirty per cent of the students were male between 20 and 30 years old, having completed primary school or possessing a vocational-training degree and without significant previous knowledge of course subjects or technological media.

Determining the model: the technological perspective

The distance courses of the Mentor Project are based upon the use of multimedia materials and on support of telematic tutoring, but both the use of these materials and the managing of the tutoring need appropriate technological media. Using didactic multimedia requires a computer, a VCR and a television. In order to establish telematic communication, the tutors need a computer, modem communication software and a telephone. Without these materials the students could not begin their distance learning. This makes the Mentor classroom especially important in the Project as a working and learning space.

The classroom is also the meeting point of students who share the same timetable, which means that the classroom can also become the place for the exchange of new ideas (there exists a space created for group activities, and common settings). The interactions that arise within the classroom will have to do with the learning process (more or less directly) while the interactions in the telematic space -- outside the classroom in this sense -- see the physical classroom as the material base and catalyst.

The technological format has advantages compared to the traditional face-to-face one, notable by overcoming space and time barriers. The results drawn from the first generation of Mentor students (60 per cent successful, 7 per cent drop-out rate) affirm that the costs of this kind of training are favourable compared to face-to-face training. It also has a very interesting added value: the satisfaction of the local authorities who can offer a range of unusual courses, and the satisfaction of the neighbours of the towns, who recognise and appraise the quality of the offered courses by means of the Mentor Project.

The Mentor Project in action

Working scheme

Establishing the Mentor Project has meant the creation of an important technological and human infrastructure both in the classrooms of the small towns in the three provinces and in the Headquarters of the Programme of New Technologies of the Ministry of Education. The actual classrooms have been created in the towns, have been furnished with technological equipment, and a person has been appointed to manage and encourage its use. The equipment (computers and telematic communication) can be found in the Headquarters of the New Technologies Programme.

Course candidates must pre-register in their local classroom, and join a waiting list. The administrator then enrols them in the course once the candidate's desired timetable coincides with the existence of a free working desk in the timetable of the classroom. This enrolment is communicated to the Headquarters of the New Technologies Programme, where the student is appointed to a tutor. The manager is also responsible for explaining the contents, reach, and prerequisites for each course. The Annexe provides a detailed description of each course, together with the associated material, addressees, prerequisites and classroom use.

During the first year of the Mentor Project, enrolment was cost free. Students received printed material, time to use the working desk, telematic communication, and tutoring. During the second year it was agreed that the town halls should charge a symbolic enrolment fee (approximately $200 in all), which is used to pay part of the cost of communication.

Students acquire the materials of the selected course and begin to participate according to their own rhythm. If aware of any learning problems, the tutor gives some advice on possible ways to solve them. Students have access to exercises to control their own progress. They may ask their tutors to clarify aspects or request advice (they will get an answer in less than 48 hours), and will be able to join in recorded tele-debates with other students enrolled in the same course.

When students feel ready to progress from one module to the next, they must apply for admission to the next exam. Exams are held periodically in all classrooms, and take place approximately every two months. A person of the Ministry of Education of the province attends the classroom whenever an exam is held. This person is in charge of certifying the integrity of all the processes. The exam is conventional: a written paper. The result is sent via fax to the New Technologies Programme, where it is given to the student's tutor, who will mark it and determine whether the student should be promoted to the next module. If not, the tutor will give precise indications on the student's weak points. When students succeed in all phases, they receive a certificate.

Mentor classrooms

The concept of the classroom seems to be closely linked to face to face education, but, in the Mentor project, the classroom represents a different concept. It is meant to be a resource centre, a meeting point and a working space at the same time. The participating town halls have prepared the classrooms, all of them with a telephone. The telematic space which has been built is the communication link among the students, the managers of the classrooms and other participants.

Towns

The peculiarities of the region explain the choice of the towns for installing the Mentor Project, out of the three Castilla y León provinces. In general in the chosen provinces there are a large number of small villages very close to one another, scarcely inhabited, with a large elderly population and whose life depends that of larger towns, themselves thinly populated, but with better facilities. They also depend of these larger towns for commerce. The towns where the Mentor classrooms have been created, though very different from one another, belong to the second category, and all of them are characterised as being the commercial and facility centre of the surrounding villages of the area. Due to this fact they fulfil one objective of the project: to spread the possibilities of training to areas of low current provision.

Equipment

The classroom is divided into different areas which allow for the development of different learning activities with specific materials and equipment. There are three working spaces: for audio-visual media, for information technology media and for group work, with a working desk for developing co-operative activities. The basic information technology equipment is composed of 4 computers, printer, fax and modem for the setting up of the communications. As the necessities of some classrooms are greater, the equipment has been enlarged.

Apart from the specific software of the different courses, the classrooms are equipped with some of the most common user software in the professional world: word processor (Word Perfect), relational and documentary databases (Dbase IV and Knosys), desktop publishing (Express Publisher), and other general purpose software, such as the integrated package MS-Works. All the software meet these two objectives: on the one hand, they can be another tool of the different training courses and, on the other hand, they can be studied in themselves, satisfying in this manner some of the specific desires of classroom users as a source of permanent training.

Audio-visual equipment consists of a VCR, television and video camera. The classrooms are also equipped with specific videotapes of distance courses and with commonly used material, such as information technology for beginners or information technology and audio-visual technology. The working area is furnished with a large round table, and there is also a basic classroom library with printed material reference and study.

Human resources: the classroom manager

There is a person specially appointed to manage the classroom and control its resources. These have all attended a training course run by the New Technologies Programme at Madrid. The individual in charge of the classroom is the spokesperson for area users, from whom others receive information about the Mentor Project directly. Besides this information task, they must also cater for student needs and provide advice on available courses. Of those involved in the project, only the classroom manager will be present throughout the student's learning process.

One of their most important tasks is to co-operate in promoting the project among the members of the town and neighbouring areas in co-operation with the local authorities of the Ministry of Education and town hall authorities. Another of their tasks is to establish promotional strategies and devise materials: posters, notices for the local press, and representation in the local mass media. Promotion is seen as a continuous process: after the first steps have been set up, it will only be necessary to renew the message from time to time and, above all, to keep the community well-informed, especially about new courses. Apart from the tasks of managing and directing, classroom managers must also create an invigorating atmosphere. If the Mentor classroom is a dynamic element of the community, the classroom manager must be the main motor of this process.

Since the classroom equipment is limited, the classroom manager must also distribute the working desks according to the interests of the students and according to the arrangement of the classroom itself in order to get the most out of the given resources.

Manager training

Classroom managers are selected at the local level. Each town hall publishes a note and establishes the job criteria (to live in the town, for example) apart from the general ones: secondary or higher education degrees, good knowledge of the area, experience in organising group work and user knowledge of information technology. Once selected, the 18 persons attend a specially designed course.

The 150-hour face-to-face course, organised in three phases, focuses on the analysis and debate of the tasks of the manager. Technological training is important and does not imply previous knowledge on telematics or equipment: the contents of these fields are widely and thoroughly treated. The aim is to train the managers in the use of technological media, and student counselling regarding the equipment and resources concerned. They are also trained in the use of several information gathering techniques and tools (questionnaires, interviews, observation), in order to evaluate the project.

Manager training emphasises group dynamics over technological aspects. Candidates do not have to possess any kind of teacher training: it is thought that it might interfere with one of the main objectives of the project -- to measure the capacity of the system to do without the presence of didactic support, saving this role for the tele-tutor exclusively.

The role of the tele-tutor

The tele-tutors' role is the co-ordination with the rest of the tutors of the same course and the connection with the Headquarters of the New Technologies Programme. The tutors chosen fulfilled the following conditions:

- specialised in the subject material of the training course;
- thorough knowledge of the student's teaching material;
- a very good command of the technological applications of the course;
- good training in the telematics communication system; and
- being a teacher or having experience of the field.

The following are the tutor's functions and tasks:

- follow the work and progress of each student, reviewing their telematics connections, to evaluate and to propose further studies;
- propose useful training topics through the question and answer board of their courses;
- update information in the databases related to the course;
- periodically renew the evaluation activities;
- evaluate the learning process.

Headquarters of the New Technologies Programme

The New Technologies Programme is responsible for:

- the design of the Mentor Project;
- creation of the necessary infrastructures;
- the setting up of the project;
- endowment of the materials;
- training of the classroom managers;
- production of the training packs;
- upkeep of telematic tutoring.

From the point of view of communications, the New Technologies Programme is the central reference and the meeting point of all of them.

The equipment dedicated to the telematic service of the Mentor classrooms can be found in the central Headquarters of the New Technologies Programme. Without this technical infrastructure and its staff, the communication among the different places and the different participants of the Mentor Project could not be possible. The first phase of the project was implemented with partial financing on the part of FEDER; then the support of the European Social Fund was sought and then the support of other sources. In any case, the financial management of the project is done from the New Technologies Programme, which includes tasks such as defining the characteristics of the equipment, the software, audio-visual material with which the classrooms are furnished and evaluating and acquiring the equipment and materials.

One of the main tasks has been to design, orient and create teaching materials which form the resource packages for the follow-up of the training courses. These materials have been created almost from scratch since there were no previous prototypes. Manager training (designing the courses, planning and giving them) and adapting manager training to distance-teaching have also been one of the important aspects of the project.

To systematise the mentioned actions and make all the tasks oriented towards the ensuring of the good functioning of the Mentor Project, the New Technologies Programme has been provided with a Management Team of five people in charge of the basic functions to follow-up, control and upkeep the project, such as gathering information about classroom incidents and taking all necessary steps to solve them, and studying the demands for further resources proposed by the classrooms. The management team is also responsible for the development of different resource packs needed to create materials and set up courses. Other tasks of the management team include managing the communication system, updating databases and telematic strategies, and participating in the design of communication tools.

The telematic system

The telematic system is based on electronic mail with a group of forums, both public and private, moderated and non-moderated; and a set of databases of exercises with an automatic or non-automatic key and a large number of statistical tools to monitor the system. Electronic mail allows the users to send and receive messages confidentially. When they become members of the system, automatically an electronic address is created, and they can receive their e-mail. It is the main pillar upon which the tutoring is based. By means of this resource, the students tell the tutor their doubts or suggestions, and following the same routine, receive answers in less than 48 hours. By means of e-mail each student will also be able to send messages to others students of the same course.

The mailing system facilitates student organisation in groups. In the Mentor Project a group consists of classroom managers, tutors, or students of one course. This allows the same message to be sent simultaneously to the individual addresses of all the members of the group. This option is especially interesting for the tutors and the managers of the system. There is a bulletin board of questions and answers, which is a forum of the controlled News type. It allows every one to ask question to an expert, whose answers can be read by everyone.

A general board for all the Mentor students also exists, which is known as "The Mentor Board", and which is dedicated to cultural information topics. There are also specific boards for each course. It is possible to find in them topics in relation to the contents of each course and also different aspects related to the actual training process: sometimes they propose different kinds of activities, some times they present the opinions of an expert. These boards allow the tutors, for example, to propose group activities, and allow the students to offer suggestions and information which might be interesting for the rest of the students of the same course. While the Mentor Board is open, the course boards ask for an identification: the user's code.

There exists another type of common space denominated "Tele-debate", associated with every course. It simulates a forum which is open for discussions in which everyone can participate. If in the question and answer boards it were possible to ask questions to an expert, the Tele-debates board is aimed at peer discussion. It does not seek information, but rather contrasts it. Thanks to this exchange of ideas, new ways of thinking can be introduced and new attitudes can follow.

Automatic evaluations

The personal-use option creates the possibility of doing exercises on-line. The exercises, which are stored in the server, are of two different kinds, corresponding to two different objectives. While some exercises are compulsory, integrated in the learning process and must be completed successfully to allow further progress, others are voluntary. Students use them to confirm their acquired level, or to simply practice. In this case, students also have the option to decide whether they want their tutor to know or not the information on the exercise which they have chosen.

The main advantages of this option are the availability of the evaluation exercises and the speed with which the student gets the marked exercise, which is done automatically once the exercise has been completed. The programme displays the results on the screen, in such a way that the evaluated student becomes aware of the mistakes and also receives recommendations for further study. Information on evaluation is recorded in the server and it can be used either by the student or by his or her tutor.

Exchanging files

When the necessity of sending a very long message or a message, which due to its complexity or characteristics must be created with a given software, arises, it is possible to generate a file with the contents of the message and send it by means of telematics. The addressee of the file receives it and, with the same software as it was created, can retrieve it to read or modify. There is also a bank of files with review exercises and further studies. At any time of the learning process the tutors can ask their students to go to that general data bank to download a certain file in which they will find an exercise.

The Mentor server does not have the option of exchanging files yet, due to technical limitations (temporary) associated with the use of IBERTEX. Until now another additional server is used based on the commuted telephonic network (PSTN), and can only be used for this activity. In the following months both functions will be integrated and it will not be necessary to leave the normal environment to send a message.

Teaching materials

One of the most difficult aspects in establishing the Mentor Project was the creation of teaching materials because, as they were meant for distance teaching they had to possess very specific characteristics and fit within the objectives of the project, such as grading the contents, and giving the student well-balanced contents for working alone, combining theoretical contents with practical applications, self-tests and different kinds of complementary activities for further study and reinforcement. This kind of material was almost non-existent. It was therefore necessary to design a "type" of package of multimedia resources, to determine the functionality of each medium, to look for the persons to create materials who would understand the spirit of the project.

The characteristics of the packs are the following:

- ***Modular structure***: Teaching material comes structured in independent modules, some of them exchangeable among all the resource packages that are offered in the classroom in order to allow students to create their own learning routes. For example, there is a common module to all courses called "Usage of technological media", which can be used whenever the student thinks it necessary. Within the course of "Management of small- and medium-sized enterprises" it is optional to pass through the "Accountancy" or "Buying and selling modules", according to personal interests.

- ***Existence of two types of modules***: Formative modules, constituted by didactic units, and the Support or Help modules, whose content is aimed at orienting and helping students in their learning process.

- ***Flexibility***: The modular characteristic of didactic material offers students the possibility to choose among the formative modules available in the classroom and, when the configuration of the materials allows it, its arrangement within the course, to limit the time they want to dedicate, and to choose the method which best suits their own characteristics. Besides, within each formative module, there are indications -- in dialogue boxes -- to choose access to other materials where they will find further study topics or reinforcement, both theoretical and practical. The student's active participation in all these aspects makes individualised teaching possible.

- ***Multimedia***: The support used in didactic resources are audio-visual, information technology, telematics and printed material, but they are used in a divergent way -- they are not integrated in only one kind of document. Nevertheless, each media possesses its own specific purpose.

- ***Self-sufficiency***: Teaching materials should be adequate to transmit all necessary information to the student on guidelines, reinforcement activities, and further study and evaluation.

- ***Telematic support***: Resources are designed to be used in distance-training without face-to-face support. In the present phase of the project, printed material is the main axis of the package: it presents the contents of the course, proposes the activities which will motivate telematic connection and provides self-test exercises, found at the end of each didactic unit.

Audio-visual material is used in different ways in each pack. The audio-visual document sometimes plays the role of reinforcing printed material (health education, electronics) and in other instances it is the main teaching material (rural tourism, leisure and audio-visual media) bringing reality closer to the student.

Resource pack software has different functions, such as:

- a tool for study in courses whose main objective is the use of information technology applications to different working areas, such as information technology in the management of enterprises, design and publishing or the learning of programming languages;

- an exercise to reinforce work concepts, providing simulations or reference materials;

- means of telematic communication to allow interaction between students, tutors and structured sources of information; and

- tools for the evaluation of the learning process.

Resource packages vary, but all are created along specific guidelines. In it, the set of elements which integrate the whole package is considered, though whenever it is necessary, documents can be added later to develop the course. All contain a guide for learning processes (description and uses of the package), formative modules, reference module (glossary, bibliography) and a module for the use of information technology media.

Considerations and conclusions

Access of adults to technologies for education

Distance-training of adults will play an important role in coming years. Today all Western countries are investing time and capital to ensure society's rapid adaptation to the changing job market. Continuous training of workers is pushing education systems to widen their offers. Their demand grows at the same speed as specialisation in the work environment, and demand grows due to the disappearance of jobs, either because they are obsolete or because new jobs are created requiring new skills. There exists however a large part of the population demanding learning for educational purposes only, in order to improve life quality. All these necessities cannot be met with simple face-to-face training, enterprises cannot face the ensuing costs, and those involved cannot be given the time needed to dedicate themselves exclusively to learning.

The growing importance of information technologies, the appearance of the concept and the presence of the "Information Society", are producing a revolution (although privileged to the vanguard) in the use of technology media in daily life and particularly in education. Infrastructure is the main problem in less-developed countries wnen they aim to use new technologies and methodologies. Communications are expensive, and the measures to disseminate them and reduce costs are important. This is why it is necessary to undertake global actions for the creation of infrastructures, and for the development of new technologies in order to approach the new methods. The role of authorities (education and other) to create the necessary infrastructures is very important, and the countries which receive them first will have advantages in placing their citizens in a world which is increasingly competitive. Once the structures have been created and the roles and methods accepted, it is possible to use distance-training for adults globally and also commercially.

Peculiarities of distance learning in the Mentor Project

The Mentor Project embodies a series of new characteristics compared to traditional distance training. These can be summed up as follows:

- The training is based upon new technologies.

- There is only telematic tutoring, which puts an end to space and time limits in education communications.

- Students have access to necessary technological equipment for learning in the Mentor classroom.

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- When students work in the classroom they are not alone, but surrounded by other students who are doing the same, which may be positive for the creation of a favourable study environment. Under these circumstances it is probable that the students meet other students of the same course (or of a different course, but sharing the same communication tools). It is therefore possible to conclude that some kind of relationship must be established among them which will lead to discussions either on the contents of the pack or any other aspect related to the learning process.

- The students have to agree on a given time with the classroom manager in order to use technological equipment.

The future of the Mentor Project

After its implantation in 18 towns in Castilla y León, the process of extending the project in further phases was undertaken. The extension does not mean in this case enlarging the number of users: it has already been said that the exploitation of the results is not the aim of the New Technologies Programme -- which is the developmental unit providing services to other units of the Education Ministry. In the following phases technological and methodological improvements were sought as well as mechanisms to enlarge the number of final users.

The Mentor Project in Extremadura has been set up in five classrooms (1994). Courses were targeted at the most populated towns using only those courses aimed at job training. Technological innovations have used the Hispasat satellite for telematic communications as well as video conferences specially designed to test new tutoring in this medium. Two classrooms have been implemented in penal institutions in Madrid. Experimental parameters have been created bearing in mind student profiles and their need for isolation, free time, as well as their attitudes towards external stimuli. This development has raised great expectations in prison authorities.

The most recent phase of the Mentor Project is experimenting with ISDN connections with two classrooms in Asturias. Deeper changes ensue with this step. The project wishes to introduce telematics with speed which will allow multimedia applications, either on-line (*e.g.* video conferences) or recorded, with access to multimedia databases. All this means the updating of the methodology in all courses, and changing tutorial activities (*e.g.* exams). This has an influence on the presentation of resource packages, which will be distributed in multimedia form (CD-ROM), and will substitute the existent multi-format media.

Evaluation of the Mentor Project

In the summer of 1995 an independent agency was commissioned to evaluate the Mentor Project. The final report has not yet been published. Students, classroom managers, town mayors, tutors, staff of the Mentor Management Group of the New Technologies Programme were interviewed. The results shows the project as an original and successful action, having fulfilled its goals. It offers several guidelines to continue educational development through the use of stable technologies, accessible in the field of adult training.

The following paragraphs are taken from the conclusion of that evaluation report. It is possible to obtain from it several interesting aspects of the widespread development, implantation and exploitation of adult training using information and communication technologies.

Evaluation of the Mentor Project in Castilla y León classrooms -- Global summary of results

"The Mentor project is a new experience in distance non-statutory education which uses information and communication technologies. With this project, the adult population of disadvantaged areas have at hand a series of quality resources which would be very difficult to establish cost-effectively through face-to-face training. The development in the 18 classrooms of Castilla y León meets the need to enlarge the training offers in rural areas, and they are addressed to a great number of adult population who need to acquire, complete or widen their knowledge and attitudes for their personal development.

The evaluation of the project emphasizes that the success of the Mentor Project is due, among others, to the following characteristics:

- Range of the project, measured in terms of geographic spread, financing and use of the classrooms.
- Previous planning, which is translated into practice in preparation and testing phases.
- Use of low proportion of resources on technical staff and concentration of most of the resources on the classrooms, managers and direct support to students and tutors.
- Special emphasis in horizontal organizational structures, with effective communication mechanisms and internal efficiency, associated with competent and professional management, achieving convergence of interests among technical staff, tutors, classroom managers, local authorities (provincial and local institutions) and students.
- Intensive use of telematics technology but user friendly handling, with few complex procedures, reflecting the needs of the students or users rather than the impositions of the technology.
- Clear and limited objectives agreed among participants.
- The achievement of the objectives of rural communities, rather than of the technologies.

The main "lessons" that can be learnt from the putting to practice of this project are :

- Context of the project

The most successful classrooms are those with a widespread area of influence. Perhaps in distance education the economies of scale are important.

- Origin and evolution

The project owes its success to an intensive preparation, very detailed in terms of planning, with pilot phases and tests before the setting up of the whole project.

The continuity of human resources from its very origin in another essential factor, especially during the first years.

- Financing the project

The success of the project seems to be linked to the relatively small number or external financial sources. This may be related with difficulties in the management and logistics of other similar multi-financed experiences, together with the risk of incompatibility among the guidelines of the different participants.

Another of the aspects which has contributed to the success is the fact that it was possible to rely on important capital resources to cover the costs of the necessary material, thus minimising the cost of maintenance. Nevertheless, and bearing in mind similar experiences, it is not advisable that this becomes a requirement of the design of future educational distance projects targeted towards rural areas.

Nevertheless, it is necessary to control the staff costs, emphasising and dedicating these to activities related to the needs of the students.

- Organisation of the project

The success of distance training for adults is in the development of experiences which use very few human resources of the teaching kind and allows a greater share of the resources to other aspects, such as those related to the needs of the students and the support of other activities like classroom managers, etc.

It seems to be important for the success of the programme to ensure the availability of qualified staff, such as managers and tutors, highly motivated and highly engaged in the project, in order to meet the specific needs of the students , included as one of the main objectives of the project.

Considering the characteristics of adult training, specially in relation to the educational level, horizontal structure seems to be associated with success in distance training.

Technological experimentation, especially to adapt to the specific necessities and purposes of the user, and commercial exploitation as well, are necessary, though in both cases it means major risks for the project.

Since these two activities are both highly risky they should not be combined at the same time and in the same situation. They should be treated separately and sequentially. Ideally the project should be open and clear in its objectives, and later it should look for self-financing, instead of experimenting with its implementation at the same time.”

APPENDIX: CHARACTERISTICS OF TRAINING COURSES

Courses	**Material supports**	**Target**	**Required level of knowledge**	**Use of the working place**
Management of small- and middle-sized enterprises **• Accountancy** **• Buying and selling**	■ Printed text for formative modules and reference materials ■ Information technology: GEXTOR software	■ Managers who wish to update the management of their enterprises ■ Persons who are working in this sector ■ Persons who plan to set up an enterprise ■ Persons looking for a job	■ Thorough knowledge of the instrumental skills of reading, writing and calculating ■ Previous knowledge of Information Technology is not required NOTE: This course is specially designed for the persons with some knowledge of enterprise managing	■ In the first third of the course printed material will be used mainly ■ From the second book the computer will be widely used in the applications
Rural tourism	■ Printed text ■ Information technology EAO ■ Audiovisual	■ Business persons who wish to update or remake their tourist enterprises ■ Persons who wish to set up a tourist business ■ Persons looking for a job	■ Thorough knowledge of the instrumental skills of reading, writing and calculating ■ Previous knowledge of Information Technology is not required	Priority order: ■ Use of VCR ■ Use of printed material

Courses	Material supports	Target	Required level of knowledge	Use of the working place
General electronics	■ Printed texts for the formative modules Instrumentation and practice ■ Information technology: Simulation software and EAO ■ Illustrative video	■ Beginners in the field of electronics ■ Persons interested in further training ■ Persons looking for their first job	■ Thorough knowledge of the instrumental skills of reading, writing and calculating ■ Previous knowledge of Information Technology is not required	Priority order: ■ Printed material ■ Simulation programme ■ Illustrative video ■ Practice in an appointed center
Desktop publishing	■ Printed texts for training and reference modules ■ Information software	■ Persons who work in publishing houses ■ Persons looking for a job	■ University or superior studies ■ User level of Information Technology	■ Use of the computer ■ Use of printed material
Health education	■ Printed texts for training and reference modules ■ Illustrative videos ■ Information software EAO	■ Every person who wishes to enlarge his or her culture in health and to improve life quality	■ Thorough knowledge of the instrumental skills of reading, writing and calculating ■ Previous knowledge of Information Technology is not required	Priority order: ■Printed material ■ Audiovisual material ■ Information technology material
Leisure and audiovisual media	■ Printed texts for training and reference modules ■ Fixed images ■ Videos	■ Every person who wishes to learn the audiovisual language and wants to be able to select a television programme	■ Thorough knowledge of the instrumental skills of reading, writing and calculating ■ Previous knowledge of Information Technology is not required	Priority order: ■ Printed material ■ Audiovisual material

Courses	Material supports	Target	Required level of knowledge	Use of the working place(s)
Computer aided design	■ Printed texts for training and reference modules ■ Information software: Auto-Sketch software	■ Persons who work in design and want to acquire applied knowledge of applied information technology ■ Persons looking for their first job	■ University or superior studies ■ User level of Information Technology	■ Use of the computer for information technology applications ■ Use of printed material
C language	■ Printed texts for training and reference modules ■ Information software: Interactive module for reference and learning (MICA) ■ Audiovisual	■ People who work in programming ■ Persons looking for a job	■ University or superior studies ■ User level of Information Technology	■ Use of the computer ■ Use of printed material ■ Use of VCR
Clipper	■ Printed texts for training and reference modules ■ Information software: Clipper	■ Persons who work in database programming ■ Persons looking for their first job	■ University or superior studies ■ User level of Information Technology	■ Use of the computer ■ Use of printed material

SWITZERLAND -- LEARNING TECHNOLOGIES IN COMPANIES

by
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Our aim in writing this report has been to draw up a picture of current in-house use of learning technologies in adult professional learning in companies and administrations in Switzerland. This has been done with the intent to pinpoint specific tendencies and problems in such a way as to contribute to the constructive on-going debate about the implementation of lifelong learning.

In order to do so, we contacted training departments of some thirty large companies[1] and a number of federal-level administrations. This report has consequently no pretensions to completeness. In some cases, companies were solely providers of educational material for third parties, but in most cases they were both users and their own providers. Training department management were questioned about in-house educational culture and context, wherever appropriate, as well as about specific goals, choices, requirements and evaluation of the use of learning technology. A brief description of a selection of those companies is presented in this report. The choice of companies to be presented was made according to what we perceived as the significance of one or several aspects of their educational context or their use of learning technologies.

We would also have liked to explore the situation of small- and medium-sized enterprises (SMEs). Available time was unfortunately limited. We did however contact a number of Chambers of Commerce and SME organisations. These discussions lead us to a preliminary and perhaps somewhat hasty conclusion that little use was being made of leading-edge learning technologies by SMEs other than those directly working in the field.

In reading the following descriptions of the use of learning technology in companies in Switzerland, one should bear in mind the forthright comment of Hewlett Packard's Richard Hill[2] who said that certain aspects of in-house training were considered a source of competitive advantage and as such could not be disclosed.

Before describing the use of learning technologies in companies and administrations, we feel it is important to set the scene by a brief description of the Swiss context including a short excursion into the use of learning technologies in higher education.

The national context

Switzerland is a relatively small country with a population of just over 7 million, yet in 1994 it had the world's highest per capita Gross Domestic Product (33 572 $)[3] and the International Telecommunication Union (ITU) indicators single it out as one of the most developed telecommunications countries in terms of equipment in the world. Only Sweden, Denmark, the United States and Japan have a higher main telephone line density per capita and 92.5 per cent of all households have at least one telephone -- bettered in Europe only by Belgium, Germany, the United Kingdom, the Netherlands and Italy. There are an estimated 2 050K PCs in Switzerland which represents a penetration of 28.8 per hundred inhabitants. Only the United States can boast a higher level. As for the Internet, there were an estimated 283 320 users in 1994, representing 3.98 users per 100. Only Finland, Iceland, Norway, Sweden, the United States and Canada have a higher ratio.

According to a nationwide survey carried out by the Swiss Federal Statistical Office, during the period from April 1992 to April 1993 more than 2 million people aged between 20 and 74 living in Switzerland took part in some form of further training in an institutional context,[4] representing 40 per cent of that age group. If we limit ourselves to professional training, some form of course was taken by 23 per cent of the adult population (1.25 million people), of which nearly three quarters did only one. The length of time spent by an individual on taking courses varied in the following way: 28 per cent spent 20 hours or less, 23 per cent spent from 21 to 40 hours, 23 per cent spent from 41 to 80 hours and the remaining 26 per cent spent over 81 hours. The total number of hours taken was around 200 million. In considering these figures it should be borne in mind that, according to the definition employed in the context of the research work carried out by the Swiss Federal Statistical Office,[5] these figures do not include autodidacts like those, for example, learning by using a built-in help-system in a computer programme.

In such circumstances one might expect to find a high level of use of information and communication technologies (ICT) in education and training in Switzerland. In a previous study about distance learning in higher education in Switzerland[6] we found this not to be the case.

Here, however, we shall see that there is extensive use of ICT in education and training in medium and large companies and to a lesser degree in administrations. At the same time, the perceived barriers to efficient use of these tools have more to do with social, cultural and economic factors than with technological considerations.

Research

A recent study[7] -- carried out in the context of a National Research Programme called "The Effectiveness of Swiss Education Systems" -- presented a detailed analysis of research work in the educational use of new technologies.

The authors note that most research in the field of learning technologies in Switzerland is carried out in universities and in small pedagogical research centres run by local authorities. The latter are dependant on local educational authorities and often suffer from a lack of exchange with fundamental research work going on in universities. As for universities, there is little research on learning technologies done in the Humanities. There is however a great deal of in-house R&D in multimedia educational software in university departments scattered all over Switzerland. A wide range of research themes related to learning technologies are covered in Switzerland with a result that none of the areas really attains the critical mass necessary to be viably present on an international level.

The authors studied seven different areas of research in Switzerland:

- Software evaluation, based on long-standing methods and requiring very little infrastructure, was the most developed of all research areas.
- Testing learning and teaching models was an underdeveloped area of research probably due to the high cost involved in creating and testing models. However this area produced many publications.
- Changing educational practices and contents -- a traditional educational sciences research theme related to pedagogical innovation and a psycho-sociological approach to school phenomena. The authors attribute the relative lack of research publications in this field to difficulties in finding reliable, controllable fields of experimentation.
- Conception and development of computer assisted learning (CAL) -- the authors found a large number of groups scattered all over Switzerland working in this field, few of whom however came from educational sciences. The authors found this state of affairs symptomatic of the split between software developers and potential users. As a result of this situation, those working in R&D set up workgroups about specific problems unaware that these had already been treated elsewhere by educational sciences.
- Computer Mediated Communication (CMC) and distance learning -- a relatively underdeveloped area in Switzerland although some research is being carried out on applications at a university level (see next section).
- Problems related to the introduction of computers -- mainly involving studies carried out on a local basis for local educational authorities. The large number of studies carried out in this area is due to the federal system in which each canton is responsible for its own educational matters.
- Specialised educational use -- a certain amount of research work is being done in the use of new technologies in the field of learning by the physically and mentally handicapped.

Swiss universities

Swiss universities have been very slow to make widespread use of new learning technologies in university-level teaching. A recent parliamentary motion led the Swiss University Conference to set up a working group to investigate the possibilities of co-ordinated integration of new technologies in Swiss Universities in the form of distance learning. The findings of the working group, if accepted, will be taken into account in recommendations made to the Federal Council of Ministers about orientations and investments for the period 2000 to 2003.

Despite the absence of any coherent policy or satisfactory co-ordination on a regional or nationwide level in the field, a number of one-off experiences point to exciting possibilities.[8] One such project is the development of Internet-based collaborative design in the field of architecture under the impetus of the architectural department of the Federal Polytechnic of Zurich (ETHZ) in collaboration with universities world-wide.

Another such project is ARIADNE, in which the University of Lausanne and the Federal Polytechnic of Lausanne (EPFL) are taking a leading role in a European-wide project, partly financed by the European Union's Fourth Framework Programme. ARIADNE aims to create an infrastructure and appropriate methodologies so as to structure distance learning material in such a way as to capitalise on material by reuse for other courses.

Another promising experience is the setting up of a postgraduate course on the integration of communication technologies in the field of education. Designed and implemented by TECFA (the Technology in Training and Education Unit of the Faculty of Psychology and Education Sciences of the University of Geneva), the course mixes in-house seminars and distance working using e-mail, World Wide Web and MOO technologies.

In the field of high-band transmissions, video conferencing is being used for courses in technology related sciences between the Federal Polytechnics of Zurich and Lausanne and in the field of medicine between the Universities of Lausanne and Geneva. The University of Basel is also participating in the European project, TESUS, about high-band network use to develop and share expertise in distance medicine, in particular during operations.

From a quite different point of view, the recently launched campaign of awareness amongst university teachers in the field of distance learning on the part of the University of Fribourg is also very interesting. Building on experience gained from a number of in-house pilot projects as well as information collected from experiences elsewhere, the rector's office seeks to overcome the lack of knowledge in the use of such technologies on the part of university teaching staff and to establish a wide basis of know-how on which staff will be able to develop future technology assisted courses.

Non-university higher education

In non-university higher education the dominant -- if not exclusive model -- is that of the traditional class. Extremely little formal educational use is made of information and communication technologies. One notable exception is the development of a postgraduate distance learning module in telecommunications in the framework of FPIT-NDIT[9] under the impetus of the EIF (*Ecole d'Ingénieurs de Fribourg*). It should be noted that considerable informal use is made of Internet (essentially e-mail and World Wide Web) in most of these institutions. This is however not generally recognised by teaching staff as being a constituent part of the learning experience.

The current reform of a part of non-university higher education in the fields of technology and management, bringing together a number of existing establishments and transforming them into state-recognised "Higher Specialised Schools" (*Fachhochschulen*), might remedy some of the problems due to the restrictive canton-based nature of such higher education but no direct plans have been made for the introduction of new learning technologies or distance learning.

On-going learning for the general public

As mentioned at the beginning of this paper, according to the Swiss Federal Statistical Office,[10] 17 per cent of the adult population in Switzerland took some form of further training outside their working context between April 1992 and April 1993. Taking this into account and considering the high level of use of PCs and telecommunications mentioned above, despite the relatively high telecommunication costs,[11] one would expect considerable use of learning technologies by the general public.

Studying the use of learning technologies in on-going training for the general public was not the objective of this report. We would, however, like to give one example, amongst many, of adult education for the general public using learning technologies. This example, ProNet, struck us because of its pedagogical approach and the discourse of its organisers about the influence of network technologies on learning.

ProNet[12] is a training programme designed to help women acquire the necessary skills in information management. The one-day course, of which some twenty sessions have already taken place is held at the cnlab of the Intercantonal Technicum of Rapperswil. Each course is attended by ten to fifteen participants most of whom are in their thirties or forties and active professionally. The course is jointly organised by the Offices for Equality of the Cantons of Zurich and Basel as well as the Office for Women's Rights of the City of Zurich, with financial support from the Federal Action for Further Training (WBO).

According to the organisers, the enormous quantity of fact-based knowledge currently available on the Internet points the way to a shift in the role of teachers from the provision of facts to the moderation of the learning process. As a result, the ProNet course is put together in such a way as to allow participants to concentrate on those subjects which interest them most. The preference is generally for e-mail and the World Wide Web. According to written feedback at the end of each course, participants perceived this flexible learning context very positively.

An introductory CD-ROM has also been prepared by a group of four women so as to provide an easily accessible tool for learning about Internet as well as examples of the uses made by women of the network for those unable to attend the course.

Goals and motivations

Knowledge is recognised by some large companies to be one of the most important assets for growth both on an individual and a corporate level. In the rapidly changing context of the global economy with its increasing dependence on widespread exchange of digitised information, the drive to learn has become an explicit part of the corporate culture of some of these companies. However, their approaches vary considerably.

Educational objectives

Mastering the use of the technology itself

The goal of most of the companies in using learning technologies to teach the use of those same technologies is to attain a minimum level of competence in their use (Silicon Graphics, Oracle, Hewlett Packard, Digital). Such individualised objectives are explicitly mentioned in Digital's presentation of its Training Utilities.

Mastering specific job-related content

Where technology itself is not uppermost, the major goal of those using learning technologies -- like most other forms of learning -- concerns the acquisition of specific content. In the case of the MIGROS, for example, this involves knowledge about products and services (*e.g.* fruit, milk-products, furniture, electronic apparatus, customer service, etc.), about the company (structure and culture) and about important behavioural issues (attitude to customers, hygiene, team-work, ecology, etc.).

Encouraging an autonomous approach to learning

A number of companies aim to encourage learning autonomy on the part of their employees. This is particularly the case of on-the-job computer assisted learning (UBS, Oracle, Silicon Graphics, Digital, etc.).

Developing untapped knowledge

In the case of JITOL, one of the major objectives was not only to provide basic knowledge about a particular subject, but also to capitalise on informal knowledge development between participants via electronic interaction so as to add to that basic knowledge.

Reasons for the choice of a technological approach

Individualised, learner-driven training

Learning technologies are seen as providing a tailor-made approach, that takes individual needs and differences in knowledge into consideration (UBS, Digital, Hewlett Packard). For those firms which consider that the learner knows best what to learn and should be left to choose, learning technologies make it possible (Silicon Graphics). They also allow the learner to set his or her own learning pace (Digital).

Just-in-time learning

One of the important reasons raised for using learning technologies is that they enable learning and provide help when necessary (UBS, Oracle, Digital). They also make it easier and faster to distribute new information (Silicon Graphics, Hewlett Packard).

On-the-spot learning

For some companies, one of the important aspects of learning technologies is that they make learning possible in the place where it is needed most: on the job (UBS, Oracle, Silicon Graphics, MIGROS).

Cost and efficiency

Andreas Kisch (MIGROS) said that the choice of using learning technologies was essentially a question of speed of delivery, cost and feasibility. He saw no viable alternative when providing widespread, basic training for the fifty thousand people working for MIGROS. In addition, he said, that thanks to the resulting decentralisation of learning, costly travelling expenses were avoided.

One company specifically mentioned that learning technologies decrease overload on existing training (Nestlé). Another mentioned that such technologies made it possible to shorten learning time (Digital).

Appropriateness for adult education

Given the specific population of learners at the MIGROS, it is felt that computer assisted learning on-the-job in small groups with colleagues and superiors is the most adequate form of adult education. This is especially appropriate, Andreas Kisch says, when learning is not "heavily" pedagogical, but helpful, motivating and above all centred on practical considerations and problem solving.

The paperless company

Silicon Graphics are in the process of getting rid of the use of paper as a form of internal communication including training. The use of such technologies as the Web are considered major assets in this strategy.

Motivating younger learners

One organisation had a particular reason for using learning technologies: to motivate young learners and to create a positive image of the administration (Federal Personnel Office).

The learners

The following categorisation of learners constitutes a convenient way of considering learners. It does not however take into account their prior knowledge or experience in learning, both of which can have enormous impact on the form and the outcome of training. In the case of MIGROS, for example, most employees are foreigners. Their mother tongue is not spoken in the area where they work and they are generally unaccustomed to learning in a traditional school-type context.

Newcomers to the firm, to the job or to a product

Learning technologies are frequently used for newcomers to the firm -- in particular, apprentices -- to provide structured knowledge about the firm, its corporate culture, its ways of working and technologies used on the job (MIGROS, Federal Personnel Office, UBS, Global Teach/PTT, etc.). Silicon Graphics, for example, is about to introduce a Web tutorial about the company for newcomers. Learning in this context is obligatory and dictated by management with the help of the training department when there is one.

A category of employees

Learning technologies aimed at a particular category of employee were not so common. A couple of companies use technology extensively to keep their customer-support team up-to-date with the latest technological developments (Hewlett Packard, Silicon Graphics). Learning is considered an integral part of the job and as such obligatory, although the choice of when and what to learn is left to employees' judgement.

Another company uses computer-based business simulation to provide on-going training for management and specialists (Nestlé). Candidates for training sign up for a course, but it is up to the training centre and the head office to decide who takes part.

All employees

When the learning population includes all employees, training is generally concentrated on supplying up-to-date information, reinforcing corporate culture or providing answers to sporadic questions (Digital, UBS, Oracle, Hewlett Packard). In this case it is the learner himself or herself who chooses when and what to learn.

In addition learning technologies are used to introduce new technologies or new procedures (MIGROS, Digital, etc.). It is interesting to note that with the MIGROS, although the choice of who learns is a management question, Andreas Kisch mentioned that management would like individuals to take the initiative of asking for training rather than being told to do so. He pointed out that computer assisted learning had been found to encourage an autonomous approach on the part of the learner, including the ability to define problems, discover failings and improve them. Such autonomous behaviour in thought, in work and in learning was encouraged by superiors.

Silicon Graphics are currently using the Web to provide information to all employees about the merger under way between Silicon Graphics and Cray Research.

Clients

Learning technologies are used to train clients by those companies selling technological solutions (Oracle, Hewlett Packard, Silicon Graphics). They are also used by companies selling learning infrastructures or courses in non-technological areas to other companies or individuals (Global Teach, JITOL).

The general public

A couple of companies questioned provide courses or plan to provide them for the general public as an extension of their current in-house or client use of learning technologies (Global Teach, Federal Personnel Office).

Content, media and methods

Types of knowledge

Knowledge is plural say Fleck and Tierney,[13] who list seven types of knowledge ranging from instrumentalities embodied in tools or tacit knowledge rooted in practice and experience to formal knowledge available in textbooks. Each form of knowledge has its own method of development and transmission. Each has its socially accepted value, varying enormously from one form to another, with a premium going to formal knowledge transmitted by books and taught in the initial institutional educational set-up.

The cases studied were classified in terms of the seven knowledge categories and the classification submitted to the people concerned for their comments. The following section summarises the results.

Meta-knowledge

Meta-knowledge involves general cultural and philosophical assumptions. Amongst our case studies, those attempting to establish lifelong learning as a part of corporate culture are working on this level (Hewlett Packard, Oracle, Silicon Graphics).

Milieu

Milieu is knowledge about the local environment, relation to peer groups, management and other staff and the general organisation of work. In combining work with a CD-ROM and discussion with a superior, MIGROS introduce elements of knowledge about the "milieu".

Contingent knowledge

Contingent knowledge is distributed and apparently trivial information specific to a particular environment, similar to on-the-spot learning. The UBS process based-learning client-centred learning might well involve contingent knowledge. Silicon Graphics consider that such contingent knowledge is provided by their Web tutorial system.

Tacit knowledge

Tacit knowledge is rooted in practice and experience. It is traditionally transmitted by apprenticeship and training. Such knowledge is to be found in a number of the training programmes we studied, especially those that permit peer exchange about ways of working (MIGROS, KITE/JITOL, Global Teach) or by simulating working processes (Nestlé).

Informal knowledge

Informal knowledge is made up of such things as rules of thumb or tricks of the trade. Generally verbal in nature it can also be transmitted in written form as guidebooks or manuals. Those companies providing practical information about the use of new technologies or practical working processes are developing informal knowledge (Digital, Global Teach, Hewlett Packard, KITE/JITOL, Nestlé, MIGROS, Silicon Graphics).

Formal knowledge

Traditionally considered as the form of knowledge, formal knowledge involves theories and formulae usually available in written form as textbooks and handbooks. Fleck and Tierney make no distinction between long-standing stable knowledge like that of the structure of the Swiss government (Federal Personnel Office) and short lived facts and figures such as details of new products (Digital, Hewlett Packard, Oracle, Silicon Graphics). All the cases we studied have a part aimed at developing formal knowledge, ranging from almost exclusively formal approach via a CD-ROM of facts and figures (Federal Personnel Office) to only marginally as a by-product of business process simulation (Nestlé).

Instrumentalities

Instrumentalities concern knowledge embedded in tools and instruments. As such they require other knowledge -- informal, tacit and contingent -- to be mobilised. Instrumentalities are tied up in all those training programmes aimed at developing the use of new technology (Digital, Hewlett Packard, Oracle, Silicon Graphics). Instrumentalities are also implicitly present in those programmes which require learners to use learning technologies even when that use is not the principal aim of learning (Federal Personnel Office, Global Teach, KITE/JITOL, UBS).

Types of learning

Daniel Peraya[14] stresses the importance in studying educational mediated communication of considering both the mediation of content and the mediation of the relationship. In the following examples, the first, learning by assimilating facts and figures, leans heavily on mediation of content leaving little or no room for mediation of the relationship. The second, learning by doing, includes the pedagogical relationship in a non-mediated form in which the instructor is in the same room as the learners (MIGROS, Hewlett Packard, etc.). The third, collaborative learning, involves a degree of mediated communication between the instructor and the learners and between the learners themselves (Global Teach).

Hannes Lubich quotes Bair[15] in defining a hierarchical classification for computer-based user interaction. Comparing cases studied with these categories seems to us worthwhile, but has its limits in that the classification was intended for computer supported co-operative working, not all of which maps onto the learning process. The following are Blair's four categories:

- *Informing*

  Information is provided anonymously in a predominantly one-way system, the provider rarely getting any feedback from the recipients even if this might be desirable for the efficient functioning of the system. This type of interaction is typical of learning by assimilating facts and figures mentioned below.

- *Co-ordinating*

  Work goals are not necessarily common although interests are often common as could also be affiliation to an organisation. Communication is generally for sharing information and resources. In the cases studied, this type of "administrative" work is not really considered part of the learning process.

- *Collaborating*

  All are participating in the same process but levels of involvement vary from person to person. Although output may be common for all, performance is judged individually. This is the case of Global Teach.

- *Co-operating*

  Individual goals are sublimed in favour of team goal's. Decisions are by consensus, output is common and the team is evaluated as a whole. Amongst the cases studied, JITOL is the closest to this type of user interaction. We exclude here the clearly co-operative work going on between teams taking part in business games (Nestlé, MIGROS) because the exchange is face to face and not mediated by computers or networks although technically it could well be.

Learning by assimilating facts and figures

In this approach the learner assimilates facts and figures from amongst those provided by the technological medium. This can be done by providing product information via the Web (Digital, Hewlett Packard, Oracle, Silicon Graphics); by using a CD-ROM (Federal Personnel Office) to inform about federal structures and governments or to illustrate processes (MIGROS); to provide basic knowledge about a particular subject (Global Teach, UBS). Little or no interaction takes place between the learner and the provider of the information.

It could be argued that browsing through product information on the part of members of the sales force with a view to preparing presentations for future clients is not a structured learning experience. Those people we spoke to who employ such a system do however consider it to be learning. Effectively, in a leaner-centred approach, structuring of material is increasingly shifted to the learner.

Learning by doing

As the name suggests, learning by doing involves actually doing those things that are to be learnt. This implies a certain amount of trial and error on the basis of the instructions given. Two types of learning by doing cropped up in the cases we studied:

- The use of technology to learn how to use that technology with the help of CBT (Digital, Oracle, Hewlett Packard, Silicon Graphics).
- The simulation of a process to be learnt either by CBT as in the case of UBS for banking processes or in computer assisted business games as at Nestlé and MIGROS.

Collaborative learning

Collaborative learning involves a learning process taking place within and between the members of a group. A number of the cases studied involve collaborative learning (MIGROS, Nestlé) but the collaboration itself is not mediated as in the case of JITOL and Global Teach.

Global Teach potentially[16] allows on-line exchange between learners and teachers in a virtual classroom set-up.

JITOL sets about getting learners to capitalise on and develop their own knowledge in co-operation with others. In doing so, it addresses the task of building on informal peer-exchange as a rich, organic source of knowledge. Building knowledge becomes a common goal of all participants and, as a peer group, no one person is singled out as instructor nor as author of the developed knowledge.

Types of delivery

Details are provided here of the technologies used in the companies studied. It should, however, be borne in mind that such a division in terms of technologies -- natural as it may seem -- should be taken with precaution. As Daniel Peraya points out,[17] it can be misleading to think in terms of individual technologies when it comes to considering the role they play in mediated educational communication. Each technological tool interacts with all other tools. Consequently, rather than considering technology globally or, on the contrary, as a number of separate entities, Daniel Peraya suggests that it would be more pertinent to consider technological tools as a number of separate but interacting variables.

In reading the following list, it should also be borne in mind that a particular sort of technology is rarely used on its own, but in a combination with other technologies as well as with a non-technology mediated approach.

CD-ROM

The CD-ROM provides a fixed multimedia content for training in a more or less interactive context. It is used by a number of companies (MIGROS, Federal Personnel Office). Silicon Graphics have just introduced a CD-ROM containing standardised office software for generalised use including an on-line instruction book.

Computer based business simulation

Computer based business simulation uses a software model to simulate business processes allowing certain variables to be modified depending on the profile of those taking part in the simulation and how the simulation evolves. Development can be quite long and requires considerable testing as Rolando Rosato-Rossi of the Nestlé Training Centre pointed out. In addition to Nestlé, MIGROS also use such business simulation.

Computer based training (CBT)

Computer Based Training is probably the most widely used learning technology in the companies we questioned (Digital, Hewlett Packard, Oracle, Silicon Graphics, UBS). CBT is software used to provide information, simulate situations and processes, and interact with the learner, including testing his or her knowledge on a particular subject.

Video conferencing

Video conferencing involves transmitting video and sound in real-time from one location to one or more others using high band networks or satellite links. As full video conferencing can be a costly solution not only because of the bandwidth requirements but also the necessary infrastructure, intermediary solutions have been devised. One-way high-band transmission can be used with a low-band return via computer networks or the telephone lines (Hewlett Packard) or transmission can be two-way using ISDN networks linked to PCs but with lower definition pictures (Oracle, Global Teach).

Network-based one-way services

The World Wide Web -- the fastest developing Internet protocol -- permits relatively inexpensive widespread provision of and access to structured multimedia information using hypertext links. The Web or a similar technology -- whether it be via Internet or privately -- is used by a number of firms to provide up-to-date knowledge in-house about products and market conditions (Hewlett Packard, Oracle, Digital, Silicon Graphics).

The essentially one-way delivery of such information involves paying attention to questions of filtering and structuring the mass of information available and providing a quality service including readability, layout, speed of access, coherence, accuracy, up-to-dateness.

Networks are also used in the delivery of CBT material for distance learning. Global Teach, for example, uses a high speed PTT network to down load working units to learners. Oracle are also preparing a distance learning system called the "Oracle Learning Architecture". Silicon Graphics enhance Web use by adding short audio and audio-visual sequences. They consider that the Web will progressively replace CBT.

Computer supported collaborative working (CSCW)

Michael Schrage in his book *Shared Minds -- The New Technologies of Collaboration*[18] says: We have telephones, videocassettes, satellites, fibre optics, facsimile machines, paper, audiocassettes, overhead projectors, whiteboards, blackboards and so on -- we live in an environment rich with tools that make it easier to communicate with each other. But where are the tools for collaboration? Computer Supported Collaborative Working (CSCW)[19] is an attempt to provide those tools by enabling people to work together at a distance, either one-to-one of many-to-many.

Amongst the companies studied here, only two use CSCW technologies in training (KITE/JITOL, Global Teach). Both involve the use of specially designed interfaces, amongst other things to support collective working.

KITE uses the JITOL four-window interface to enable the on-going development of knowledge between peers. Users are connected to each other via a central database and each of the four windows on the learner's machine correspond to a different activity: an evolving knowledge base; electronic debates; e-mail; personal note-taking.

In the initial JITOL project no satisfactory automation of the complex process of sifting out knowledge and consolidating was found. The process was carried out by the JITOL researchers with a group of experts related to the topic treated. In the current service-providing context using JITOL, a much simpler process has been evolved so that users, after initial training, are able to carry out the process themselves.

Christine Gardiol of KITE points out however that JITOL is not just a tool but above all a methodology aimed at improving group management, information exchange and learning in the context of collaborative working.

The Global Teach interface allows a group of learners and a teacher to work together in virtual classroom set-up using screen-sharing, white-boards and video conferencing.

Factors affecting learning

Individual motivation

Communicating information is a necessary but not sufficient condition for workable knowledge to be created. According to Pascale Viret, European Training Manager of Silicon Graphics, the success of the learning process ultimately depends on the learner himself or herself. Learning is made more difficult in Europe, she says, because taking the initiative of organising their own training doesn't come naturally to most Europeans.

At Hewlett Packard, employees are encouraged to see themselves as responsible for their own development. Analysis of the yearly evaluation of each employee leads to the drawing up -- in direct collaboration with the employee -- of a written individual training and development plan for the coming year. These plans are assembled in a database which the training department uses to propose appropriate training. Bruno Elmer of Hewlett Packard Switzerland mentioned the difficulty of encouraging individuals to see training as their personal responsibility, to think of it in a longer term perspective and to take their own initiative in learning.

Corporate context

In considering the role and the impact of corporate culture on learning within companies, it is interesting to note that expertise, according to Fleck and Tierney,[20] is "carried" by groups rather than being located in individuals. Such knowledge groups -- each with their own vested interests and their specific ways of seeing things -- do not necessarily correspond to existing divisions within companies, but overlap and extend beyond company boundaries. This has always been the case, but increased use of wide-scale networking tends to accentuate it. Consequently, re-engineering corporate culture requires more than an individual approach or even a company-wide approach.

The most striking aspect of training at Hewlett Packard is the important place it plays in corporate culture and the means used to enhance this role, amongst other things, via the use of new technologies. Development of personnel is rated a major company priority. Knowledge is considered an essential asset in gaining a commercial advantage over competitors. Corporate culture is spread and developed in various ways including using a recently developed CBT available on each workstation.

Amongst barriers found to developing a corporate learning culture at Hewlett Packard, Bruno Elmer of Hewlett Packard Switzerland quoted:

- lack of dedicated time and resources for training;

- too little importance granted to education and the impact of training;
- insufficient occasions provided by management to use what had been learnt;
- the educational message was not strong enough.

Although the efforts to improve the corporate learning culture have been fruitful, it is felt that employees at Hewlett Packard still tend to lack a medium and long term perspective of their personal development and are reticent about taking personal initiatives.

Learning context

In both the training of clients and in-house engineers at Silicon Graphics, learning takes place more readily when the client/learner is confronted with a specific problem or need. Without this necessity, it is very difficult for individuals to find time in the working context to consult training or information material. The success of such training depends on the ability of the individual to create a "space in time" within which to learn.

Christine Gardiol of KITE pointed out that embedding the learning process in work without setting aside a specific time for it means that participants have to put in extra hours which results in a continually decreasing motivation on the part of learners.

According to Richard Hill of Hewlett Packard, traditional courses have the advantage of obliging participants to take time off for learning and are seen as interesting and consequently motivating by participants because they enable them to meet others. Technology in training is found to work well when used in the field of technology itself (in customer support, for example, where some 20 per cent of time is taken up in learning) or when there is cost pressure or some other highly motivating force.

As Andreas Kisch (MIGROS) put it, there is a natural tension between working and learning, but the two need to grow together. A number of firms (MIGROS, UBS, Global Teach, etc.) found that regular use of computer-based training on the job -- as opposed to being a source of up-to-date information or an on-line help -- required the provision of a space dedicated to learning to shelter them from interference coming from the production process. Alternatively, slack moments have to be found, according to Andreas Kisch, in which effective learning can be done.

According to Bruno Michel of Oracle, resistance to the use of learning technologies in the absence of a teacher has been found to be much stronger in Europe than in the States. Pascale Viret of Silicon Graphics voiced the same opinion. It is felt that this resistance is partly due to attachment to traditional learning patterns rooted in the way schools work. Oracle's answer to this problem has been to encourage collaborative learning in a small group working face-to-face with a subject matter expert who can advise and present tricks of the trade. According to Andreas Kisch, MIGROS also found that working in small groups was more efficient as it allowed employees to discuss their own ways of working.

Oracle found language to be a barrier in Switzerland as material is generally in English and many people's English is not sufficiently good for them to feel comfortable using it in a highly technical context. Oracle has chosen to have its material translated into the local languages.

The "contract learning" approach adopted by Digital, involving a guarantee about the outcomes of the learning process over a fixed period, irrespective of whether technology or people's jobs change, constitutes a shift away from traditional teaching practice which places the onus of delivery on teachers and of outcomes on learners.

Recognition of knowledge acquisition

One might imagine that wide-scale recognition of acquired skills would allow learners to capitalise on them on the job-market and as such would constitute a considerable incentive to learning. The theme of certification and recognition of knowledge acquired in informal contexts has been a subject of discussion in such circles as the OECD and the European Union.[21] In Switzerland, one of the outcomes of a parliamentary motion by Mrs. Stamm concerning modular education in on-going adult training, has been an initial report concerning the recognition of portfolios of key qualifications prepared by Mrs. Anita Calonder, President of the Swiss Federation of Adult Education.

Amongst the companies we contacted, those involved in in-house training -- whether it be their own or that of others -- often expressed concern about being able to measure the effectiveness of training but made no mention of the need for the recognition of the skills of individuals. However, those few ventures contacted that were involved in providing access to training for individuals like Global Teach were aware of the need. The promoters of the Global Teach learning platform, for example, have approached organisations like the ITU with a view to obtaining official recognition of courses.

It is interesting to note that on reading the above, Richard Hill wrote that Hewlett Packard realised there was a need to recognise skills and knowledge acquired outside formal training programmes but that they didn't know how to go about it. He had the impression that universities systematically blocked any attempts to "certify" informal learning, even in the United States. Discussion with other companies led him to believe they had similar views.

Pre-service training for staff used as instructors

Few of the companies questioned made direct use of staff as instructors and amongst those who did (Hewlett Packard, UBS, MIGROS), few mentioned providing special training for them.

The members of MIGROS required to use the Videomit CD-ROM system in staff training received a brief training session in its use.

Heinz Gerber of Global Teach stressed the need for a complex range of skills drawing from a number of different disciplines on the part of those acting as "TeleTutors" in the context of mediated distance learning. Global Teach are currently drawing up a list of the key skills required of such TeleTutors and plan to encourage a training organism to prepare a modular course in "teletutoring" to be available via the Global Teach system.

Role of instructors and learners in the learning-scenario and how technology changes these roles

In the "browsing" kind of learning (Digital, Hewlett Packard, Oracle, Silicon Graphics, UBS), a selection of information and educational material is made available from which learners are free to choose according to their situation and their needs. Unlike the Internet-type situation with globally distributed sources of information, the choice available to the learner in the company is finite and remains dictated by the trainer or information provider. This "browsing" approach to learning requires news skills on the part of both learners and trainers.

As Lucia Kleiber of ProNet mentioned, the fact that information is widely available on networks such as Internet is shifting the role of the trainer from a supplier of facts and figures to a learning-"moderator". This ties in well with the perception of Heinz Gerber of Global Teach, mentioned above, who talks of the specialised skills required by "TeleTutors".

With JITOL -- as a peer learning system -- there were no clear-cut roles of teacher or student. Depending on the topics, participants were either novices or experts. The moderation process was generally put in the hands of the non-expert as it was felt he or she would force others to be explicit about their knowledge.

Assessment

A number of cases studied mentioned the need for assessment of performance. UBS, for example, in their new CBT about banking procedures have incorporated an assessment system that measures acquisition of theoretical notions. Practical, process-based notions are evaluated on-the-job by the person's superior. The Global Teach interface also includes mechanisms to assess the learner's progress.

Richard Hill of Hewlett Packard stressed that it was important to fix learning objectives and test learners to see if objectives had been reached. He raised doubts however about the exact nature of what was being tested. Testing, he said, could also be an ingredient for motivating staff to learn.

In the case of MIGROS, attainment of educational goals is evaluated both by the learners themselves using an electronic questionnaire that is analysed by those responsible for training and through discussions with their superiors on the job.

Concluding comments

The extent of learning

Discussion of the somewhat ambiguous nature of learning by "browsing" -- is it really a learning experience? -- raises the question as to the definition of generally accepted boundaries to learning. In the context of lifelong learning, these boundaries would be considerably extended to include informal types of learning.[22] This in turn raises the question as to the appropriateness of a formalised educational approach in such cases. In the provision of Web-based information about new products for the sales force, for example, to what extent would a pedagogical approach to the mediation of content improve the efficiency of its use? And should that be the case, how would such a "learning orientation" be communicated to those preparing information?

Mediated relationships

In the learning technologies explored here, much more attention is paid to the technology-based mediation of content than to the mediation of the relationship whether it be between the learner and the instructor or between learners themselves. In many cases the presence of an instructor is considered to be a necessity but current methods use face-to-face presence rather than telepresence.

Wide-scale extension of such systems -- as Andreas Kisch of the MIGROS pointed out -- would be quite unfeasible with traditional means. Efforts have to be made to facilitate the introduction of forms of telepresence in learning technologies used in industry and administrations.

Development of teletutoring skills

In the extensive use of learning technologies relying on wide-scale telepresence, the role of people who can facilitate on-line working will become crucial. As Heinz Gerber pointed out, there is a need to draw up a list of requirements of essential skills for TeleTutors and to provide a satisfactory scheme to develop such skills. This is one potential example of sharing the load of learning between companies.

Collaborative working

Most technology-based learning in the cases treated here makes very little use of technology mediated collaboration. A number of signs point, however, to an increased need for the use of CSCW. In the context of the global economy in an information-based society, the ability to work collaboratively at a distance will become an increasingly vital asset. The drive for increased innovation also calls for wide-scale cross-disciplinary collaboration on a flexible basis that only computer supported collaborative working can make possible. Wider use of CSCW in learning would not only create a basis on which subsequent use of CSCW in working could be built, but would also help to actively extend our existing knowledge-base by tapping in on rich informal peer-exchange along lines similar to those used by JITOL.

As Hannes Lubich points out,[11] there is insufficient contact between developers of CSCW systems and the end-users. Means should be found to encourage an on-going dialogue between users of co-operative working systems and those whose job is to design them.

Corporate culture

A number of those questioned for this report insisted on the necessity to make learning a major objective in corporate culture. Such a corporate engagement is an essential condition for widespread up-take of lifelong learning. It is possible, however, that the implications of such an orientation and the changes in structure that it necessitates are the source of considerable resistance that make becoming a "learning company" difficult to achieve. The same is no doubt true of attempts to shift the initiative for learning to the individual.

The role of the learner

In a number of the cases studied, the need for learners to take the initiative in shaping their own development via learning was mentioned. There is clearly a drive in many areas to individualise learning and to shift the choice of when and where to learn and to a certain extent for what to learn to the individual. Clearly, wide-scale lifelong learning cannot take place if the mass of learners need an immense host of trainers to shepherd them around. This increased learner autonomy runs parallel to a change in the role of trainers from fact-providers to learning-moderators working at a distance. It is probable that the move to a predominantly learner-centred approach to learning with the concomitant responsibility of the learner can only be successful in a working environment if it is goes hand-in-hand with increased freedom and responsibility of the employee within the company.[24]

The place of learning

The general trend of many of the companies studied here was to integrate learning into the working context. There were, however, some misgivings that this might lead to a clash with the need to get work done quickly and efficiently. As a result, a couple of people advocated setting aside time outside working hours for learning. No one went so far as to shift the onus of learning to the learner and have it done at home as is taking place in some companies like Bosch in Germany.[25]

Assessing knowledge requirements and acquisition

Assessment of knowledge requirements and knowledge acquisition is part and parcel of individualised learning technologies. It might be interesting to explore the use of a software system like that suggested by Pierre Lévy and Michel Authier[26] involving a visual mapping of individual knowledge within a given community.

Recognition of learning acquisition

Despite the interest of at least one company -- Hewlett Packard -- it seems unlikely that the initiative for recognition of acquired knowledge and skills will come from companies. Yet, recognition is an essential factor in motivating people to continue learning as they would be able to capitalise on such learning on the job market. No doubt the initiative must come from the State in collaboration with institutions providing content and systems for learning as well as organisations representing employees and workers.

Exchange of information

Some of the comments about the draft version of this document indicate that companies are not always aware of work going on at a government level -- whether it be Federal or European -- or in university research. It would no doubt be profitable to step up exchange and collaboration between industries, administrations, public authorities and universities in a concerted effort to introduce lifelong learning.

Postscript

Implications for research, practice and policy

Most policy makers in education and training are the first to be informed and made aware of the important role they can play in shaping the new "market" of learning technologies. Both, governments and private business, in Switzerland would do well to look at developments in other OECD countries, while respecting the specificities of a multilingual, multicultural country like Switzerland.

Aside from the key issues of insuring fair access to all learners as well as that of respecting basic copyright legislation for learning technology products, the following areas should be particularly addressed by policy makers:

- Many fundamental research and development areas related to learning technologies are underdeveloped and in dear need of receiving more political support, if not resources. A focused research agenda could be implemented, based on existing analyses. If one believes in the role of research also in monitoring effective and efficient innovation, R&D could become an important trigger for concerted action in the development of transnational multimedia markets for education and training.

- Critical market masses are hard to achieve in a small country like Switzerland, further handicapped by its federal system and its multilingual and multicultural entities. Policy making could therefore be given enhanced responsibilities for joining public and private productive sources and promoting sustainable joint ventures across borders.

- Another crucial task awaits policy makers: creating a marketable reward system for adult learners having acquired new skills and competencies with learning technologies. Policy makers could envisage going beyond questions of certification of learning by promoting incentives for companies, both large and small, to recognise knowledge acquired in-house or in other "non-formal" learning settings. If we speak of the importance of developing new corporate cultures, it should be understood that learners' autonomy and collaborative working are two sides of the same coin for the lifelong preparation of the workforce, both in public and private enterprise.

Short case studies

Digital

Aware that the outcome of training depends very much on the context and is not guaranteed by the sole use of technology, Digital have developed what they call a training facility in which companies subscribe to a training programme including an assurance about outcomes for a flat quarterly fee. It is not so much the technology which is sold, but the outcomes which are guaranteed. Clients training needs are analysed, objectives set, solutions proposed and if one tool or method proves inappropriate others are used.

Digital have found that the use of ICT (Information and communication technologies) in training can lead to considerable resistance especially in Latin countries where it is felt that the absence of direct contact and the use of technology is synonymous with cheapness and insufficiency. For this reason all training in Switzerland involves some form of direct human presence.

A five year PC Training Facility involving 140 employees began early 1995 in Gland with UICN (*Union Internationale pour la Conservation de la Nature*). The contract involves the training of PC users and aims to provide each participant with the necessary skills to use his or her PC in a competent and autonomous way. Training is modular, self-paced (just-in-time) and tailor-made for each individual. Should the requirements of an individual change during the period of the contract or should new software be introduced, the relevant on-going training is covered by the contract.

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Hewlett packard

Hewlett Packard employs some 500 people in Switzerland and has a number of regional learning centres (Bern, Zurich, Geneva) for employees. Individual plans for training are developed annually on the basis of an evaluation of the employees work over the past year.

Various learning technologies are employed including CBT and video conferencing. According to Bruno Elmer, some 20 per cent of in-house training is done via CBTs and this figure is expected to rise. CBTs include product demonstration, help with computer use and development of corporate culture. Video conferencing for training -- used once a month by customer support services and a couple of times a year by commercial staff -- involves one-way video broadcasting from the States with added interactivity via the in-house computer network and over the telephone.

As with many other large companies, much support is provided via in-house network-based information sources similar to the World Wide Web and the use of e-mail -- directly accessible from the various home pages -- for questions.

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Oracle

Learning technologies are used by Oracle Switzerland both in training employees and customers in software use. Three types are used:

- Interactive distance learning to create virtual classrooms via two-way video conferencing.
- Media based training on workstations either for individual on-the-job training or in a classroom context.
- Internet based services, currently limited to administrative and sales information, will be extended using the "Oracle Learning Architecture" to be unveiled summer 1996.

Learning is part and parcel of contracts sold to clients who are free to chose from a number of forms of learning. As a result, learning is high up on the agenda of corporate culture. The sales force has needed special training to be able to sell packages including software licences, service and training. This training has been done using CD-ROMs in team learning context.

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Silicon graphics

Two different forms of training going on at Silicon Graphics lead to interesting conclusions in relation to the use of time.

The first concerns the training of clients using Silicon Graphics workstations. Clients fit into two broad categories: the engineers and the non-technical users. Training for the latter -- who tend to be reticent about computer-based training -- takes place in a traditional classroom context with the help of computers. For the former, training takes place on the workstation at their working place using a system called "System Tours". The client -- as an engineer -- already has a certain knowledge of computers and their use. "System Tours" provides the necessary minimum information needed to be able to use the workstation. This is done either via a general introduction or by the use of a menu or a search function for particular aspects. If further advice is required, Silicon Graphics operate a telephone Hot Line.

The second concerns keeping in-house engineers up-to-date with details of the latest product developments. This is done by the use of a number of internal Web pages maintained by the respective divisions. Should the engineer require additional information a mail function on the Web Home Pages can be used to request advice or help.

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Global Teach/PTT

Global Teach is an electronic learning platform developed jointly by the Global Teach Consortium involving the Swiss PTT, Deutsche Telekom and Telefónica de España as a follow-up to EPOS, a European project carried out in the context of the DELTA programme.

Global Teach includes several parts:

- A catalogue for learning modules in which training providers can rent space. Modules can be down loaded or ordered for delivery by traditional means.
- A tutoring system allowing the creation of a virtual classroom using screen sharing and video conferencing as well as a control mechanism allowing teachers to control what learners are doing.
- A quality control system using a BBS (Bulletin Board Service) to allow learners to evaluate each learning module. The evaluation results are subsequently made public.

- A billing system, allowing training providers to bill learners.

Global Teach underwent a three-month trial period at the end of 1995 involving the training of some 200 Swiss postmen and women using three learning units (geography, quality of work and corporate culture). Since workers do not have fixed working places, a room was set aside and equipped with computers for them to learn in.

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MIGROS

MIGROS employs about 60 000 people in Switzerland. Much of the training is carried out on the job. Until recently this was done using a series of a hundred U-Matic video programmes called VideoMit prepared by the central learning department of the MIGROS co-operative in Zurich. The videos covered such topics as sales, customers, security, management, etc. The videos were initially planned for the training of newcomers to the company, but as staff has been relatively stable over the years, emphasis has shifted to on-going training.

Since mid 1995 MIGROS have been successively replacing those videos that have the widest use by a series of CD-ROMs. All people required to teach using the CD-ROMs received special training. Users found it easier to use than the earlier U-Matic VCRs. Each supermarket has its own VideoMit "promoter" who is responsible for the equipment and can help out with pedagogical questions. Use of VideoMit varies from place to place. It can be used as a stand-alone learning method, but experience has shown, according to Andreas Kisch, that learning is more efficient when done in small groups. Gilles Stern of MIGROS Neuchâtel explained that an accompanying person was necessary, amongst other things, to point out local differences in ways of working with regard to the standard VideoMit presentation.

MIGROS also use specialised software to simulate management processes in business "games".

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Nestlé

Nestlé invest considerable sums on in-house training. Building basic skills goes on at a local level the world over, more advanced skills and attitudes are dealt with at the International Training Centre near Vevey.

In terms of learning technologies, Nestlé are major clients for computer-based business simulation. One of the most recent being Nestlé Business Simulation, a multi-functional, adaptable role-playing exercise involving five imaginary companies in which levels of complexity can be adapted to the knowledge of users and the markets can be varied according to the type of product chosen.

Nestlé believes in using as far as possible its abundance of in-house knowledge, skills and experience. Much of the training carried out at the local as well as at the international level are conducted by Nestlé staff. Nestlé privileges direct contact of its managers at all levels with the participants. Nevertheless, because of an accelerated rate of growth in its size and geographical spread, the use of computer-based training has become more and more of a necessity for the transfer of specific knowledge and skills to specific segments of its employees world wide. Studies are currently being carried out to define and select best methodologies and tools to meet its needs.

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UBS

The Union Bank of Switzerland is preparing a radical shift in staff training programmes from a product-based approach to a process based one. The processes are define in terms of the client needs. CBT units based on such processes are being developed and will be available on-line at all workstations. The aim is to introduce a completely decentralised training system into the everyday working context. When a problem arises, the employee can withdraw from the production process and check-out and improve his or her knowledge by way of a simulation of the relevant procedures. For those who require a more thorough training rather than on-the-spot help (such as newcomers or apprentices), special rooms are to be set aside for learning.

The system is designed to be self-sufficient and learners are expected to be able to learn on their own. However, it is planned to provide a hot-line to allow employees to directly ask the training staff questions. Although the training system includes testing mechanisms for concepts of a more theoretical nature, it is up to the person's boss to check that key notions have been satisfactorily grasped in practice.

The training interface will include:

- a test for knowledge on a specific procedures;
- training material;
- exercises.

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KITE – JITOL

JITOL is the product of a like-named project within the European Commission 3rd Framework Programme DELTA which ended in 1995.[27] JITOL involves the use of a "four-window" computer environment for distance learning and working. One window is dedicated to an evolving knowledge base. The second is used for electronic debates, the third for e-mail exchange and the final one for personal note-taking. Participants are connected to a centralised database and can communicate directly with each other. A modular approach is adopted to knowledge, dividing it up into "topics". Participants do much of their preparation "off-line" thus reducing telecommunications costs. In addition, participants were helped in expressing themselves in the forums by the use of pre-prepared forms. The knowledge base constituted for each topic containing essential basic knowledge is continually built on via a process of capitalising[28] on discussions taking place between participants, that is to say, by extracting important aspects of electronic interactions and reorganising them.

It is this passage from informal to formalised knowledge as well as the definition of a number of evolving ways of working that seem to us to constitute the major assets of JITOL.

KITE is an SME set up by Geneva-based researchers who had worked on the initial JITOL programme. According to Christine Gardiol, member of KITE, the hybrid nature of JITOL, cutting across traditional frontiers between learning, communicating and working, makes it difficult for organisations to come to grasps with it. Two contracts are currently under way. The first, for the World Health Organisation, uses JITOL in the training of workers from ONG's and associations combating alcoholism and drug abuse in South Africa. The second employs JITOL for training by the Medical faculties of the Universities of Lausanne and Geneva.

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Federal personnel office

The Federal Personnel Office offers an extremely wide range of courses for civil servants working for the Swiss Confederation, but up to now does not use ICT-based learning technologies in this context.

The Federal Personnel Office are having a CD-ROM prepared for use in the training of apprentices working in Federal offices. Co-ordination, design and production are being carried out by Schweizerischer Electronik Unternehmen (SE), Bern, the one-time federal arms factory. The CD-ROM, currently in the design phase, will include information about the federal offices as well as basic civic knowledge (laws, parliament, federal court, etc.). The contents are initially designed to prepare apprentices for the Federal Apprenticeship Exam but it is hoped to subsequently market the CD-ROM for all interested citizens. The CD-ROM is designed as a stand-alone learning method. Each apprentice has to work through it on his or her own with the use of a PC/CD-ROM in the service he or she works for.

Easier to use and more motivating according to Mr. Grossrieder, it is hoped the CD-ROM will encourage apprentices to come back and work for the Confederation at a later date.

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NOTES

1 One of our starting points for contacting firms was the list of members of CBT Switzerland (Computer Based Training) and the Swiss Interactive Multimedia Association (SIMA).

2 Those quotes containing no specific reference to a published document have been taken from interviews carried out with the person mentioned.

3 All the following figures unless otherwise stated are for 1994 and taken from *World Telecommunication Development Report*, ITU, Geneva, Oct. 1995.

4 Swiss Federal Statistical Office (1995), *La formation continue en Suisse. Enquête de 1993*, Bern.

5 *Op. cit.*, pp.13-14.

6 Peraya, D. and McCluskey, A. (1995), *Tendances actuelles de la formation à distance en Suisse*, TECFA/OFES, Geneva/Bern.

7 Mendelsohn, P. and Jerman, P. (forthcoming), *Les nouvelles technologies de l'information appliquées à la formation*, NRP33/TECFA, Bern/Geneva.

8 For more details see Peraya, D. and McCluskey, A., *op. cit.*

9 *Ibid.*

10 *Op. cit.*

11 The cost of local telephone calls in Switzerland is higher than in any other of the world's higher income countries. Monthly residential telephone subscriptions are also higher than any other European country. Residential installation charges are however around average. In Europe only the United Kingdom and Sweden have higher monthly business telephone subscriptions (World Telecommunication Development Report, ITU, Geneva, Oct. 1995).

12 For further information, contact: Dr. Lucia Kleiber, ProNet, cnlab-ITR, Rapperswil.
Phone: 41 55 23 47 19 E-mail: lkleiber@itr.ch

13 Fleck, J. and Tierney, M. (1991), *The Management of Expertise: Knowledge, Power and the Economics of Expert Labour*, PICT, University of Edinburgh, Edinburgh.

14 Peraya, D. (forthcoming), "Educational mediated communication, distance learning and communication technologies. A position paper", in *Educational Mediated Communication*.

15 Bair, James H. (1989), "Supporting co-operative work with computers: addressing meeting mania", in *IEEE Computer*, Vol. 4, pp. 208-217, April, quoted in Lubich Hannes P. (1995), *Towards a CSCW Framework for Scientific Cooperation in Europe*, Lectures Notes in Computer Science, Springer, Berlin, p. 889.

16 Cost, according to Heinz Gerber of Global Teach, currently makes having the necessary facilities to use this facet of Global Teach beyond the scope of most users.

17 Peraya D., Educational Mediated Communication, Distance Learning and Communication Technologies. A position Paper, in *Educational Mediated Communication*.

18 Schrage, M. (1990), *Shared Minds -- The New Technologies of Collaboration*, Random House, New York.

19 For a discussion of the definition of CSCW see Lubich, H., *op. cit.*

20 *Op. cit.*

21 The European Commission suggests the setting up of a voluntary knowledge accreditation system at a European level. See European Commission (1995), White Paper on Education and Training, "Teaching and Learning. Towards the Learning Society".

22 See the European Commission's White Paper on Education and Training, "Teaching and Learning. Towards the Learning Society", or the Green Paper on Innovation. See also various documents of the OECD Education Committee about questions related to lifelong learning.

23 *Op. cit.*, p. 60.

24 See Tom Peters' eloquent arguments in favour of empowering employees in Peters T. (1987). *Thriving on Chaos*. Excel, United States.

25 See chapter on Germany in this volume.

26 Authier, M. and Lévy, P. (1992). Les arbres de connaissances. La Découverte, Paris.

27 Davies, G. and Samways, B. (1993). *The JITOL Project and Model in TeleTeaching*. Elsevier Science.

28 Verdejo, M.F. and Cerri, S.A., *Building an Evolving Knowledge-Base from Computer Teleconferening in Collaborative Dialogue Technologies in Distance Education*. NATO ASI Series, Springer, Berlin.

De Sanctis, C., Lewis, R. and Gardiol, Ch. (1994). *Sharing Professional Knowledge: the JITOL Approach*. 3rd IRNETD Conference 1994, Milan, June 23-25.

UNITED KINGDOM -- TECHNOLOGY FOR ADULT LEARNING

by
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The national context

Publicly funded adult learning in the United Kingdom is delivered through 456 colleges of Further Education, which provide vocational and general education for people from the age of 16 upwards; 150 universities and colleges of higher education, and a large number of (generally small) adult education centres. In the last decade the proportion of mature students[1] participating in formal learning has expanded rapidly, and they now form more than 50 per cent of all enrolments in both further and higher education.

Education and training in the United Kingdom is the responsibility of four Government Departments, the Department for Education and Employment in England, the Welsh and Scottish Offices, and the department for Education in Northern Ireland. Although there are differences in the structure of the educational systems, developments in relation to technology in education have been broadly similar. Government policy is to devolve a large degree of control over the management of post school education to individual institutions. The bulk of public funding for Further and Higher Education is channelled through independent Funding Councils and for vocational training it goes through independent local Training and Enterprise Councils.

The Higher Education (HE) sector is the most developed, and its Funding Councils have invested centrally in information technology for HE through their Joint Information Services Committee (JISC), which has created the Joint Academic Network (JANET) which networks all higher education institutions, providing access for all academic staff and for students in some institutions. SuperJANET is currently being developed to provide HE with broadband communication (90 institutions currently have access for real time multimedia, video conferencing, sound and video, etc.). JISC also finances a range of support services on technical and policy issues to institutions, including access to major UK and international databases, mailgroup services. An independent committee (the Higginson Committee) has recently reviewed and reported on the issues as they affect the 500 Further Education institutions.

The larger and more effective training market generated by new technologies will support key national priorities. Especially, it should encourage greater investment in training by employers and individuals, and greater responsiveness to training needs by training providers by offering:

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[1] "Mature" is generally defined as over 21 years of age at the time of entry.

- access to some types of training from virtually anywhere, bypassing institutional, social and geographical barriers;
- access to training materials that are constantly updated;
- greater control by individuals and employers, especially of the time and pace of training;
- access to sources of information from around the world;
- the economies of scale afforded by a larger market;
- access to advice and information about training opportunities;
- access to tutoring and assessment facilities.

Major trends

The UK government's national priorities on the use of new technology in education are:

- to continue to raise the general level of IT capability in schools, Further Education (FE) colleges and initial teacher training;
- to maximise the benefits of new technologies for teaching and learning;
- to develop network literacy;
- to provide appropriate advice, support and training for teaching staff in the use of on-line educational applications and services;
- to develop and build up the infrastructure of equipment and connectivity, both within and between education institutions within the United Kingdom and abroad.

To help achieve the above national priorities, the UK Education Departments will:

- support and encourage the piloting of new communications technologies in education, including the educational special needs sector, and to ensure that advice on the use of these technologies is made available through the National Council for Educational Technology (NCET), Scottish Council for Educational Technology (SCET), Further Education Development Agency (FEDA) and other bodies;
- make available resources to enable the provision of equipment and of training in the delivery of IT capability;
- liaise with industry to promote the development of on-line applications of IT in education and training;
- review arrangements for teacher training to ensure that they keep pace with technological developments;

- review progress on the SuperJANET project and disseminate outcomes of the project as widely as possible;

- work at national, European and wider international levels to ensure that the interests of education are taken into account by organisations concerned with intellectual property rights, payment mechanisms, standards, protocols and the compatibility of technologies.

It is expected that competition between services (the telecommunications and cable companies) will help keep costs down to educational users. Nevertheless, it is likely that because of costs most educational users will 'follow a phased approach from narrow to intermediate and ultimately broadband networked systems. To allow this, it will be necessary that internal network installations are of sufficiently high bandwidth.

Superhighways for education

In January 1995, the government issued an invitation to the telecommunications, cable, broadcasting, information technology and multimedia industries to work with the education community to develop, through a programme of industry funded pilot projects, commonly accessible national, and ultimately international, education superhighways. The education departments then promised a consultation document to help bring together the worlds of education and commerce.

The consultation document "Superhighways for Education" was published in April 1995. The paper pointed out that the higher education sector in the United Kingdom is already a pioneer in the field of superhighways through its work with the JANET and SuperJANET networks. The paper was a step to extending to all phases of education in the United Kingdom the progress that has been made in higher education. The paper committed the government to fund the evaluation of innovative new proposals for teaching and learning using the new communications technologies.

The consultation document posed many questions of relevance to adult learning. In further education, they related to:

- which applications and services should be developed on broadband networks;

- which features of broadband networks would lead to more efficient use of resources and increased participation.

In higher education, the questions asked:

- how SuperJANET is affecting styles of teaching, learning and administration;

- the balance between supply and demand;

- the feasibility of the expansion of SuperJANET services to include further education and schools.

For adult education and education in the workplace, the questions concerned:

- the developments of basic literacy and numeracy skills;

- lifelong learning;
- workplace training.

DfEE -- Superhighways for Education: the way forward

The responses to the further education consultation paper indicated the need for professional support and training of staff, access to specialised learning materials, video conferencing, remote access to industrial environments and the provision of training for industry-based students.

In higher education it is too early to discern widespread, radical changes in teaching and learning styles as a result of the SuperJANET project and associated developments. But evidence so far has indicated the potential for enhancing teaching, learning and administration as well as research. Concern has been expressed, however, over international connectivity, in particular the narrowness of the international bandwidth is perceived as a restriction to higher education institutions particularly for their research needs.

Some FE colleges are connected to JANET. This has proved valuable where FE colleges teach HE students on a franchise basis. Access centres for school and college visits to SuperJANET sites were generally seen as a possibility for raising awareness of broadband curriculum based applications in advance of any widespread availability of broadband connections to schools and colleges.

Responses also indicated that networking offers considerable potential for access to specialist courses and assessment procedures. Broadband networks were seen to offer the prospect of Integrated Learning Systems for adult literacy and numeracy. Interactive tutorial support and remote assessments of competencies were seen as potential benefits of broadband networks for workplace training.

Narrow band connections to the Internet are growing. The growth of Internet services, produced for education and including features designed to prevent pupil access to undesirable material, were generally welcomed as a stepping stone to future broadband services.

High tariff levels were seen by some as a deterrent to colleges taking advantage of on-line services. Even when equipment has been installed, fear of telecommunications bills can limit the use of technology.

Government was not seen to be the only or necessarily the main driver of progress. Developments within the commercial sector would hold the key. Government would however have an important role in identifying appropriate standards and technologies.

Many respondents were concerned about intellectual property rights as the use of networks grows. It was recognised that products on networks would have low distribution costs and a balance might be possible between availability to consumers and a reasonable profit margin to producers.

Cable companies have indicated that they are hoping to use the radio spectrum to provide broadband access to rural areas. They feel it will be possible to deliver digitally encoded multimedia signals over a bandwidth comparable to that of cable delivery. They are also working on the problem of return paths needed in an interactive system, probably using ISDN lines. Other respondents suggested a national educational satellite capable of transmitting to the whole of the United Kingdom but it was recognised that the cost would be high and that interactivity would be difficult. It was recognised that the development of very small aperture terminal (VSAT) satellite technology might offer a long term solution for two-way high bandwidth networks.

It was generally recognised that many of the problems cannot be solved by a single government, they require international resolution. Such problems include cross-border compatibility, intellectual property rights, operating standards and protocols.

The UK Education Departments have agreed to evaluate selected pilot projects on the use of superhighways in education. To select the projects for evaluation, the Education Departments have used three main criteria for selection:

- the educational clarity and relevance of the project;
- the type of technology to be used, with a minimum threshold of intermediate technology;
- commitment by proposers to full sponsorship of project costs so as to ensure continuing commitment to the commercial development of on-line applications and services to education.

The projects selected for government funded evaluation also provide a range and balance across the education sectors and the United Kingdom. The range includes:

- partnerships on foreign language teaching between UK institutions and institutions in the European Union;
- a 2 Mbit/second network linking teachers working on curriculum development and the management of learning;
- linkage of a college and schools on an ISDN local network leading to a nationally recognised telematics certificate;
- broadband network linking of a TEC and a group of FE colleges with eventual extension to employers;
- pilots extending the use of British Telecom's (BT) CampusWorld network;
- establishment of multimedia learning centres within schools in a local authority area with broadband links to each other;
- relaying of remote sensing satellite data via intermediate band links;
- on-line access to hospital operating theatres for teaching purposes (2 Mbit/second TV link) with bi-directional audio for interactive discussions with surgeons during operations;
- data transmission across cable systems at 10 Mbit/second for school access to the Internet and libraries of CD-ROMS;
- delivery of GNVQ IT courses by use of broadband technology;

- interactive broadband cable technology linking 30 schools, colleges and two universities for curriculum development, development of network literacy and the use of superhighways in education-business links;
- a wide area network piloting the value of broadband technology for home-school links;
- the application of broadband TV-based video-on-demand in schools and homes;
- development of IT skills of parents and children.

The evaluation of the projects will be managed by the National Council for Educational Technology in England, Wales and Northern Ireland and by the Scottish Council for Educational Technology in Scotland. Most of the pilot projects will last for about one year. The results of all the evaluations will be published in 1997.

Further Education Learning and Technology Committee

The FEFC established its Learning and Technology Committee under the chairmanship of Professor Sir Gordon Higginson in October 1993. Its remit was to provide advice on measures the FEFC might take to promote the use of technology to enhance the provision of further education.

The committee reported in November 1995. The main recommendations are concerned with:

- access of colleges to a high speed communications network;
- creation of specialist information and advisory centres;
- staff development;
- funding of demonstration projects;
- an evaluation programme of all the initiatives funded by the FEFC.

The cost of the initiative is likely to be £84 million over five years with up to £60 million provided by the Council and £24 million by the colleges. The committee has recognised that there are many difficult questions to which there can be no certain answers. Such questions include:

- the commitment of senior management to the development and use of IT;
- which technologies will be available to be used by teachers and students;
- what advantages will emerge in the next few years;
- will new technologies take mass lifelong learning into homes and workplaces;
- what will future generations of students expect;
- what is education's role in developing society.

Overarching problems which need to be resolved even when the network structures exist are:

- the shortage of good quality courseware;
- the separateness in most institutions of management information services used for administration and the networks used for teaching/learning;
- the need for radical thinking about the role of technology in learning;
- the need for staff development at all levels.

The Teaching and Learning Technology Programme (TLTP)

The Teaching and Learning Technology Programme has been mounted by the Universities Funding Council and its successors, in two phases up to 1993/94, with a total commitment of £33 million from the funding bodies. With the direct and indirect contributions from the host institutions, the overall funding for TLTP projects amounts to £75 million.

The 76 projects in the programme fall into three broad categories: subject based consortia developing courseware across a wide range of subject-disciplines; single institutional projects concentrating on implementation of learning technology and related staff development, and a small number of institutional projects developing a range of materials of generic interest such as study skills and computer based assessment.

One of the key features of the programme is the extent to which staff from different institutions have worked together in subject based consortia. They have been able to pool their knowledge and expertise to produce technology based materials for distribution to the whole higher education sector at minimal cost.

Training and Enterprise Councils

Training and Enterprise Councils (TECs, and LECs in Scotland) are local bodies led by employers to support and lead education and training related to employment in their areas. They receive substantial funding from government to run a range of programmes, and generate income from other sources. The former Employment Department (ED) has since the late 1980s funded projects on access to information and learning. An association for Database Services (ADSET) was formed as a cross industry forum, and National Training Information Central Support (NTICS) as a support unit and helpline for TECs and LECs. NTICS is developing a CD-ROM as a national source of learning information.

DfEE has also encouraged the development by TECs and LECs of Training Access Points (TAPs) sited throughout the country for easy access to data on learning by individuals. In 1994/95, a consortium of NTICS, Northwest TAP Ltd, Devon and Cornwall TAP, South Bristol Learning Network and Guildford Educational Services was formed to improve technical aspects of information delivery. There are now over 3 000 TAP access points and in the last year over two million enquiries have been made by individuals.

In April 1995, ED issued a prospectus to TECs -- "Local Strategies to support individuals' Lifelong Learning". Projects include home pages on Internet giving access to information databases, TEC to TEC links by ISDN line and the development of information on CD-ROM relating to careers, qualifications, employment, labour market and financial information. It is recognised that there is a need to develop much more software on learning materials.

Students with learning difficulties or disabilities

The use of Information Technology (IT) by students with learning difficulties and disabilities has been developing at an increasing rate of the past ten years. There are some areas where spectacular success has been seen, particularly in the use of access technology for able students with physical and visual disabilities. There are other areas, particularly including students with learning difficulties, where the development has been less well managed.

The National Council for Education Technology (NCET) is funded by Central Government to help bring about developments in the use of modern technology. NCET's post-16 special needs work has concentrated on the further education sector. There have been links with the Nation Federation of Access Centres, Skill and the Basic Skills Agency and the NCET has recently completed a project on behalf of the DFEE on Access to Learning through Technology for students with learning difficulties and disabilities.

The Higher Education Funding Council for England allocated £3 million in 1994-95 for a second year of special initiative projects to increase access to higher education for students with special needs. The dissemination of this work is being co-ordinated by Skill -- The National Bureau for Students with Disabilities.

In Spring 1995, the Information Systems and Services Committee (ISSC), a sub-committee of the HEFCE Joint Information Systems Committee (JISC), invited proposals from its service providers for projects to make JANET services more accessible to disabled people.

The FEFC is currently carrying out an evaluation of provision for students with special educational needs in the post-16 sector. The committee looking at disabilities and/or learning difficulties, chaired by Professor John Tomlinson, is gathering evidence and consulting with appropriate customer groups. Within this study there will be an element with a focus on Information Technology.

Despite the very wide range of possibilities that can enhance access to students with learning difficulties and disabilities, good practice is not as widespread as it should be. Some of the reasons behind this are:

- lack of availability of appropriate high quality technology for these groups of students;
- lack of confidence in using IT amongst tutors, both for their own purposes of recording, as well in the application of the technology to meet student training needs;
- lack of facilities for individual student assessment for appropriate IT provision.

Current developments in IT will have a major impact on provision. The DfEE has recently commissioned the NCET to undertake a preliminary study of the potential role of virtual reality technologies in special education. The Department will also be addressing further the potential opportunities which may be offered by information superhighways.

Ways forward

Action in the future will be taken at both further and higher education levels in the following areas:

- improving opportunities for open and distance learning and emphasis on learning rather than teaching;
- deregulation;
- use of networks;
- attainment of educational goals;
- staff development needs to deliver curriculum through the new technology;
- access to new technology;
- increased bandwidth giving multimedia capability;
- infrastructural issues;
- nature of courseware;
- cost effectiveness of new technology.

IT will be increasingly used in assessment by FE and HE institutions. It has evident potential for recording and analysing results, tracking progress of students, diagnostic and adaptive testing and in integrated learning systems. The benefits of using IT include saving of staff time, ease of analysis, increased motivation of students and assessments possible at the time and place where needed.

A pilot project is underway in the United Kingdom using computerised placement tests developed by the American College Board and the Education Testing Service. The project uses adaptive tests in English proficiency and aspects of mathematics with student applicants for entry to each of ten FE colleges. The tests deliver a raw score and advice on the programme which a student should follow. The pilot is attempting to match the test results to English programmes of work and qualifications.

A potential advantage of the system is that output from the computerised placement tests (CPTs) can be fed to a general computerised management information system (CMIS) so that student tracking becomes possible. This possibility is timely in the United Kingdom where an individualised student record system is being introduced nationwide by the FE Funding council. Already the UK colleges see CPT's as user friendly, as better than personality or IQ based tests and easy to administer.

The impact of IT on learning has been substantial. While the future can never be predicted with certainly some developments are highly likely:

- an increased emphasis on private study through the use of new technologies;

- a change from classroom based tuition to learning in learning centres where students work by themselves;

- educational institutions becoming more flexible and responsive to the needs of individual students (terms like "full-time" and "part-time" courses may become less significant);

- learning and training will become lifelong;

- learning processes and teaching inputs will become more exciting and more enjoyable;

- an increase in distance learning and learning in the home using the new technologies.

For these things to happen and be successful, education and training providers will need to consider:

- ways of inducting students to the use of new technologies;

- new approaches to course design;

- access to ever increasingly sophisticated hardware and software by all sections of our community;

- pre-service and in-inservice training of staff at all levels in the new technologies and approaches to learning;

- quality assurance procedures for courseware;

- the changing needs of employees in industry and commerce and of the self-employed;

- the cost effectiveness of new technology.

Agencies in the United Kingdom which can help educators, trainers and students meet the demands of the information age include:

- the Higher Education Funding Councils;

- the Further Education Funding Councils;

- the National and Scottish Councils for Educational Technology;

- the Further Education Development Agency;

- the National Information and Learning Technologies Association.

All of these bodies offer advice on the use of new technology in the FE/HE and in the schools sector and are concerned with the development of appropriate hardware and educational software. Most of these bodies have their own Websites, and information on them, and details of specific initiatives like TLTP can be found at the National Information Service (NISS) at http://www.niss.ac.uk.

The UK government has launched a major enquiry called Technology Foresight which is focusing on the contribution which science, engineering and technology can make to the competitiveness of UK business. Many of the findings relate to education and training and how these can be improved through the use of new technologies. The enquiry recognises that learning, education, training and retraining are essential in each of the decades of life.

Management within educational institutions need to decide what they wish to do with IT. The answers may be:

- to provide staff with easy access to a terminal or their own PC;
- to ensure that staff can acquire material;
- to allow staff to assemble material as they wish;
- to arrange that staff and students can use the assembled material in a classroom, in a learning centre, via cable links to homes or in places of work (*i.e.* both LANs and WANs need to exist);
- to ensure that staff have IT competence generally and are skilled in a multimedia authoring language.

In the United Kingdom, an important forum for the discussion of developments in multimedia is the Multimedia Advisory Group set up by the Department of Trade and Industry (DTI). The group has an education sub-group chaired by Professor Arbuthnott of the University of Strathclyde. The aims of the sub-group are to explore from an industrial perspective:

- opportunities for the use of multimedia and information highways in education;
- obstacles to their future use;
- the role industry can play in enabling the education sector to make efficient use of new technologies.

Case study 1 -- Pharmacy

This is a study of the application of technology to an area of university based professional education. The Pharmacy consortium for computer aided learning (PCCAL) is funded through the TLTP programme, and involves a number of universities in collaborative development work.[2]

Objectives

How and why goals were chosen

The PCCAL project was set up to improve the efficiency of pharmacy undergraduate education in the United Kingdom. This included the development of computer aided learning (CAL) modules in order to widen the variety of teaching resources available to pharmacy undergraduates. In addition, certain packages were developed for financial or ethical reasons. For example, the award winning package "Simulations of Pharmacological Experiments on the Guinea Pig Ileum" has been used to replace animal experiments, without loss of academic value. This has resulted in savings in laboratory expenses, and has been important in reducing the use of experimental animals. Simulation and demonstration of the working of expensive industrial equipment such as the filling of capsules, can also save expense and enhance the learning experience.

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[2] This case study is based on material supplied by Keith Brown, Steven Moss and Peter Redfern, School of Pharmacy and Pharmacology, University of Bath.

The population of learners and how they were selected

The PCCAL project started as a consortium of all 16 schools of pharmacy in the United Kingdom. Consequently, the target audience for packages was initially pharmacy undergraduates. However, the pharmacy curriculum covers such a broad range of disciplines that the PCCAL software has been used effectively with students on degree courses that cover aspects of the pharmaceutical and life sciences.

Why technology enhanced approach rather than a traditional approach was used

The enhanced learning offered by CAL software was used in order to support and complement existing approaches and teaching methods.

Comparison with previous practice

The use of educational technology for teaching pharmacy is not new. As a discipline, pharmacy has a strong track record in the use of computer aided learning and teaching both in undergraduate teaching and in continuing education. Previous to the PCCAL initiative, the development of courseware was undertaken by academics at all of the schools of pharmacy. This meant there were little or no efforts at avoiding duplication, or in ensuring consistency of user interface across materials developed in the United Kingdom.

The start of the PCCAL project introduced co-ordination to CAL developments in pharmacy. The principal objectives of the project were to minimise duplication, and maximise interchange of courseware developed to a common standard. The common standard included an agreed house-style which introduces a high level of consistency across packages, meaning that students no longer have to familiarise themselves with a different user-interface every time a different CAL programme is used.

Cost-effectiveness of new approach

The cost-effectiveness of the PCCAL packages is a factor under consideration as part of the overall evaluation, the results of which will not be available until 1996. However, the increasing sales of packages and the responses to customer satisfaction questionnaires indicate a high level of usage of the PCCAL software. Early feedback indicates that the packages have been well received, and are being used in a range of undergraduate courses, both in the United Kingdom and in universities around the world.

Curriculum delivered and technology used

Brief description of the curriculum

The learning materials are intended to cover the pharmacy undergraduate curriculum. This curriculum is wide-ranging and includes subjects such as pharmaceutics, pharmaceutical chemistry, pharmaceutical biology and pharmacology. As such it overlaps significantly with other disciplines, such as pharmacology, biology, medicine, physiology and nursing.

The courseware developed is suitable for use in private study by undergraduates, or as aids in tutorial/workshop classes. The materials cover the following areas:

- remedial CAL programmes for the reinforcement of first year lectures;
- courseware supporting aspects of pharmaceutical science which have a numerical content;
- simulations of laboratory and practical experiments which are at present restricted on financial, practical or ethical grounds;
- learning materials relating to professional aspects of pharmacy covering areas such as pharmacy law and ethics, prescription validation and drug information retrieval.

Software, hardware and other technology used in the classroom and elsewhere

All PCCAL software is easy to install and can run over a network. The learning materials are delivered to students using the "Caleidoscope for Windows" Courseware Delivery System (CDS). This software provides students with a set of easy-to-use orientation tools leaving them free to concentrate on the academic content of the software. In addition, Caleidoscope includes useful administration features such as a student tracking facility, which makes a record of students' usage of each package.

Following hardware surveys in the United Kingdom in 1993 and 1994, it transpired that 90 per cent of computers available to students were IBM PCs. Furthermore, the majority of these computers were relatively "low tech" machines, for example a computer with a slow processor and a monitor capable of displaying just 16 colours. This meant that in order for students to use packages, it was essential that a "low tech" approach be adopted, and that software be designed to run on a relatively low specification machine. The "low tech" approach has the advantage that software will run on almost any machine, thus increasing usage and maximising the number of potential customers.

Staff and student attitudes

Evaluation results indicate that users feel "in-control" and that packages are "easy-to-use". As a consequence, there has been no detectable resistance by students to the PCCAL packages.

On the other hand, the level of staff resistance in certain institutions can be a significant factor in determining whether the packages will be used with students. In the early stages of the project, PCCAL recognised that resistance by some academics may be a factor, and adopted strategies that would try to overcome or minimise this resistance. For example, the life cycle of a courseware package is designed to encourage the involvement of staff by providing opportunities for academic feedback throughout the development process. Also, PCCAL has been actively involved in promoting awareness and dissemination by publishing a newsletter, and running seminars and workshops. Although the success of PCCAL is largely a result of effective collaboration and co-operation across universities, there is still some work to be done in changing the culture within certain departments or institutions to embrace non-traditional teaching methods.

Staff training

The simple design of the PCCAL packages has been extensively evaluated. The results indicate that users feel "in-control" and are able to navigate and orientate without any previous instruction or training. The training of staff or students in using the PCCAL software has therefore been unnecessary.

Level of technological skill needed to participate in the programme

A basic understanding of Windows is the only pre-requisite to using PCCAL packages.

Roles of instructors and learners in the curriculum and how the use of technology has changed roles

The PCCAL project has delivered learning materials as a flexible teaching resource, so that each package can be used in ways appropriate to a particular department or academic. For example, one academic may timetable a package with students in order to replace a laboratory practical. Another academic may decide to use the package as a lecture aid by projecting the computer screen onto an OHP display. Yet another academic may simply refer students to the package as useful background material for use in their own time.

How student achievement is measured

The CAL software contains various devices intended to test a student's understanding of the subject matter. In general, the devices are an integral part of the package, and typically consist of self-assessment questions. For example, a series of multiple choice questions may be presented to the user, directly following a tutorial section in one of the CAL modules.

Implications for practice, research and policy

Adult access to learning technologies

The "low tech" approach adopted by PCCAL has been a significant factor in ensuring that the range of courseware developed can be used on the computers that are available to students. Although development of multimedia materials that include sound and video may be more attractive for developers and users, it is important to target courseware at the lowest common denominator of computer hardware. This may mean that courseware may not be as exciting or demanding as leading-edge developments, but it does mean that there are no special requirements that could prevent implementation.

The experience of PCCAL has been that courseware which is a fully integrated and mandatory part of a degree course will be used far more effectively. The willingness of academics to embrace learning technology and to adopt courseware as an alternative and effective educational resource is also important.

Infrastructure issues

The major issues aiding or inhibiting the development of adult learning technologies are:

- the numbers, types and uniformity of the computer hardware available to students;
- usability/consistency of the CAL software;
- version control in the development of learning technology,
- maintenance/updating of CAL software;
- finding information on the available resources in a given discipline.

Government's role in the development of adult learning technologies

In the case of PCCAL, it would not have been possible to develop the range of teaching packages without the TLTP funding. Recently PCCAL has been successful in obtaining extended funding on the basis of a business plan that outlines how PCCAL will become self-supporting within three years. Without this extra support, the initial funding would have been largely wasted since the unsupported materials would quickly have become out-of-date. The additional funding enables the PCCAL Resource Centre to continue to maintain existing material and to develop new materials, albeit on a reduced scale.

Government's role in development/facilitation of markets for adult learning technologies

It remains to be seen how effectively consortia like PCCAL can establish themselves as truly self-supporting. Some level of long term support may be essential to secure the investment already made.

Case study 2 -- Teaching with independent learning technologies (TILT)

Like the previous study the TILT programme at the University of Glasgow was funded by the TLTP programme but it is one of a few TLTP projects that are designed to show how technology can increase the efficiency of teaching and learning throughout a single Higher Education Institution.[3]

TILT has grants of £751 750 from TLTP and £125 000 from the University of Glasgow's New Initiatives fund. The project, which runs for three years until December 1995, aims to demonstrate how to use Information Technology effectively in teaching methods, especially to support more independent learning.

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[3] This case study is derived from material provided by Gordon Doughty, Robert Clark Centre for Technological Education University of Glasgow.

The strategy was to embed TILT within the university, so that the results of the project could be integrated across the institution. TILT research assistants were placed with members of course teams in teaching departments, so that these departments learned from their involvement in action research on the design of teaching. Teachers learned how to work more effectively in course teams and in courseware development teams.

Objectives

The main objectives are:

- to introduce courseware to a wide range of staff and students;
- to train students throughout the university to work independently with a computer to handle numerical and textual data;
- to establish methods to select, evaluate, develop, customise and recycle learning software packages;
- to adapt and apply methods of evaluating learning as a way of improving the integration of IT into Higher Education;
- to provide staff training at the University of Glasgow and to disseminate throughout the United Kingdom.

The project is proceeding through four main phases to:

- create (gather, adapt or produce teaching material);
- evaluate (deliver learning to classes and apply suitable evaluation methods);
- debate (present and discuss evaluated case studies); and
- disseminate recommendations within the University of Glasgow and beyond on the effective use of IT for learning in Higher Education.

TILT is disseminating its results through discussions, reports, workshops, training and the Internet.

The participants -- The population of learners and how they were selected

The learners are the staff involved, their colleagues and their students. The staff were self-selecting. Anyone who wanted to take part in the project came to a series of meetings. Those who agreed to take part were responsible for one or more classes on whom IT innovations could be tried and fully evaluated over one year (but preferably two or more). The teacher also had to have backing from colleagues and departmental provision of accommodation and overheads to house research assistants.

TILT employs thirteen contract staff. They support the 26 permanent staff who proposed the project, and work with 33 other colleagues in 20 departments. More than 2 000 students in six faculties are taking part.

The University of Glasgow's ITTI Project Establishing Multimedia Authoring Skills in Higher Education has provided experienced staff, as well as training material and software examples.

TILT is organised by a Project Director with a Steering Group, representing important university committees and the chairs of the six working groups in which TILT Project members operate. The working groups are concerned with:

- handling numerical data;
- using low cost software;
- handling textual data;
- multimedia: applications;
- evaluation;
- dissemination of TILT's results.

The Evaluation Group, based within the Department of Psychology, is developing methods of observing and measuring the actual performance of IT related methods of teaching. To date, the group has performed over twenty evaluation studies of TILT courseware, from early piloting stages with small groups of representative students through to full classroom trials within a degree course. In some cases the same courseware has been studied in three successive years in the classroom, and the group is thus beginning to build up a longitudinal aspect to the work. The ultimate objective is an evaluation method which may be run by teachers, or others, with as small a contribution as possible from specially trained staff.

Why technological approaches?

Properly integrated into the curriculum, IT can help with specific learning problems. In certain situations it can probably be more effective than any other media, for example in dynamic graph drawing, models which are under student control, simulations to save equipment and to further ethical practice, drill and practice to replace material often covered poorly in crowded tutorials, or an illustrated lecture to improve visual communication. This certainly has been the experience of several teachers in TILT, particularly in the fields of dentistry, engineering maths, statistics, zoology, languages, music and history.

The TILT project is identifying what kinds of IT work well in the curricula of a wide variety of subjects, and in what areas of these subjects it is most beneficial. The impact of IT compared with other aspects of teaching and learning is being measured and particular attention is being paid to discovering the benefits which CAL can offer over traditional learning. In the modern institution with large classes, wider access and a more varied range of skills intake, the use of IT has been found to convey significant advantages. The benefits are not confined to students who have had prior computing experience.

Comparisons with previous practice

- IT as supplementary educational tool

IT has its place amongst tutorials, practical demonstrations and hands-on experience as a useful educational tool. It may not replace other teaching aspects but it contributes to the quality and reinforcement of the teaching experience.

Hispanic Studies has noted that earlier versions of computer based work led to students requesting (and obtaining) additional classes. This was not because they found the work more difficult, but because it was more enjoyable and offered, in their opinion, a more clearly focused set of learning objectives than those found in other types of class. This year new courseware has been integrated into Beginners and Honours degree revision courses in Portuguese. An evaluation case study will be available later this year.

- Learning resources

One group is developing a Resource Questionnaire to gather information on the learning resources used by students, how useful they were perceived to be, if any increased or decreased their interest in a topic, and how easy they were to access. The resources asked about include not only lectures, tutorials and courseware, but books, handouts, notes, and discussions with other students. Versions of the questionnaire have been used in six studies so far. In one study, students reported using between six and twelve different resources for a single topic. They showed variation in which resource they found most useful.

The ability of a teaching innovation to address a specific need or gap in the current teaching of a topic should be emphasised to the students. They should be fully aware of the resource's value in helping them fulfill the objectives of a course, and clear about the contribution the resource will make in helping them successfully complete the course's assessments.

- CAL's advantages over traditional learning

In the case of dentistry, evaluative studies were carried out of the first introduction of computer based learning resources within a traditional practical laboratory course in periodontology. Overall, the findings were that their inclusion was worthwhile. Over a four-week period, students were asked to keep a diary noting their confidence of attaining the learning objectives of the different laboratories. As they worked through the tutorial, practical and CAL exercises, the diaries showed an increase in confidence for each laboratory.

- Self-paced learning

The self-paced nature of CAL appeals to students and there is evidence (through a logging facility) that a number are returning to use the software as a resource for independent learning and revision.

- Cost-effectiveness

In addition to CAL produced at the University of Glasgow from original materials using authoring software, much of the project work has revolved around developing or modifying "professional" style packages in-house. As an institutional project, TILT is interested in the merit of using professional packages when compared with the teachers' own productions. The project has identified valuable ways of saving time and expense in importing external professional packages, learning how to select, customise and recycle learning software packages developed in other institutions, and producing a low-cost package locally, using readily available and easily learned software.

- Economic reasons to change

Using examples from TILT studies at the University of Glasgow and elsewhere, we aim to:

- help UK HE staff to identify and evaluate the costs and benefits of investing in the wider application of IT to teaching and learning;
- recommend ways of recognising IT solutions which are cost effective and provide value for money;
- promote minimising costs by developing staff skills in providing low-cost software and recycling existing learning packages to suit their own students' needs.

Curricula delivered and technology used

TILT operates in many subjects from accountancy to zoology. Many case studies are completed, and more are still in progress, using software that has been selected, evaluated, developed, customised or recycled. Some of these packages are available to other institutions, as completed packages or for trial.

The departments involved and the developers were encouraged to select the authoring software which best served their needs, rather than adopt an institutional standard, thus ensuring valuable experience in a wide variety of authoring software.

TILT is evaluating many different ways of using IT for teaching and learning. For example, IT may be used as a productivity tool, a communication tool or to provide learning materials.

Staff and student attitudes

Needs expressed by staff

A survey of Glasgow University staff carried out just before TILT started showed that few teaching staff regarded themselves as complete novices with computers, many already used them for some aspects of their teaching, and a large number were interested in adapting their own material for computer supported presentation. Consequently, TILT saw its task less as consciousness-raising, more as showing how the new technologies can be used wisely for teaching. The survey found that (from the 65 per cent response rate):

- only 7 per cent of teachers stated they were "complete novices with computers";
- 77 per cent had computers in their own workspace;
- most teachers used word processing software, many also used spreadsheet, database, graphics or statistical packages;
- more than half used computers for producing their own course handouts and overhead presentations;
- 25 per cent request their students to access on-line course related materials such as skills exercises, databases and analysis tools;
- 1 per cent provided some computer based learning resources for student use;
- 65 per cent declared themselves interested in adapting their own teaching material for computer supported presentation.

What kinds of evidence can be used?

To be successful, IT must be tailored to suit the many different perceptions of what university teaching must provide. Difficulties in adopting IT have tended to centre on lack of time, lack of support staff, lack of information and lack of suitable materials. TILT recommendations below should help overcome these.

University teachers and administrators require convincing that it is worthwhile to invest in IT for their teaching. The kinds of evidence demanded varies considerably, but the TILT staff have found that among the most compelling are results from a properly conducted analysed and reported evaluation process, favourable case studies showing the successful integration of IT into the curriculum, and an enthusiastic response from students.

Departmental enablers and other enthusiasts spread the use of improving teaching methods through the Teaching and Learning Service of the university. Some teaching departments may also fund the release of staff for curriculum development and training in the way being currently used by the Teaching and Learning Service. Since TILT began several posts, some part-time, have been created within Planning Units of the university to support IT in teaching.

Student issues

Every student presented with CAL materials has a unique combination of learning experiences which dictates their initial response to the material. It is often assumed that a major influence is their computing experience. However, Group E's work has found that students who report being almost phobic of computers will still use the technology because they feel it has something to offer them, or are concerned they will disadvantage themselves if they do not use it. The crucial factor appears to be selling the value of the package to the students. If the students are convinced the package is of use to them, lack of computer skills or fear of computers will not stop them using the package. Once in front of the packages, the students discover that interfaces today are routinely sufficiently user-friendly.

When a tutorial-based CAL package is presented to students, we commonly hear two forms of interpretation of the purpose of the intervention -- students who view the intervention as a practical exercise, and students who view it as they would a book, overhead or lecture, and so take notes. We have, in an evaluation of the Fast Fracture package (TILT Group B) with third year students, seen how susceptible to small influences students' approach to a CAL package can be. The students reported that they had never encountered a CAL package before, and were told shortly after they began using the package that they could take notes if they wanted to. All promptly took their notebooks out of their bags and began copying most of each screen. Progress became so slow the students were again told that the package was now available to them to access whenever they wished, so comprehensive note-taking during the session was unnecessary. Most students then started to take fewer notes, look at each other's screens, and occasionally discuss the material with their neighbours. Therefore, despite these students being at the end of the first term of their third year and hence fairly experienced learners, they were obviously susceptible to the suggestion of an expected method of working through a CAL package.

Strategies can be developed for widening interest in the use of CAL materials. For example, to encourage use of the e.mail system, bonus marks might be offered to any student who sent e.mail to the course lecturer and asked for the bonus points. For simple tasks the number of marks need not be high. This can be adapted into courses developing computer literacy skills.

Staff training

Because TILT is embedded within the teaching and service departments of the university, dissemination and interaction take place on a daily and local basis. Many presentations have been made within the university. There has also been substantial collaboration with TLTP and CTI[4] subject groups such as Music, Statistics, History and Languages, and with many TLTP projects in Scotland.

A series of talks, case studies and workshops have been presented to staff. Details were provided in a leaflet mailed to all Glasgow University teaching staff. Some of these have now become standard staff training courses.

Integration of learning material into courses

During and after the TILT project period great changes in course design in some areas need support. A support team, with personnel expert in authoring software should assist teachers.

It is important that some of the support staff are also subject specialists, *e.g.* in the biomedical field, so that they can interpret the needs of their teaching colleagues, and also contribute to the authoring of new software in subject areas not yet covered by available packages.

The strategy within TILT was to employ a wide range of expertise but not as a centrally-located team. Rather, the project was organised into 6 groups, working in 20 departments. An IT expert was located in each participating department, each with a different skills mix.

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[4] The Computers in Teaching Initiative (CTI) provides a number of support centres to assist academic staff in using technology in particular subject fields.

Evaluation

There should be a central group of experienced evaluators who go out to do work on site: the evaluators' experience of methods is there combined with that of the teacher in order to interpret the observations, and decide what adjustments to the overall teaching are most practical.

Quality of outcomes produced to date

TILT has been disseminating its results within the University of Glasgow through discussions, reports, workshops and staff training to ensure that departments not directly involved will benefit. TILT is producing a series of reports -- on evaluation, case studies, pedagogical effectiveness, cost effectiveness, changes to curricula and to teaching methods, and resource investment.

Although learning software was not a specified outcome of the project, packages in several topics are being made available beyond the University of Glasgow. Learning packages have been produced and up to three rounds of evaluation have been made with real classes.

In many cases helped by TILT staff, more teachers in the University of Glasgow are now using, or making plans to use learning software. Some Planning Units are seeking support from TILT with making great changes in curriculum and course delivery, especially because of changes demanded by the profession they serve -- *e.g.* for biomedical, medical and teacher training degrees.

The impact that TILT has made is very large when considered in terms of the amount of funding per student or staff member at the university.

Roles of instructors and learners and how IT has changed them

Students working in an interactive environment should have clear pointers to routes by which they can find answers to their questions regarding the material being covered in class. Tutor support for students in the same period as they are using interactive learning, and support time offered at well publicised times prior to an assessment, can boost learner confidence greatly.

A class of twenty to thirty students working independently on computer based material quickly adopt their own speed within the overall time frame of the course and will proceed quickly through familiar topics; they may skip topics in which they have already acquired mastery and they may elect to visit subject areas in an order not anticipated by the lecturer. Certain classes may be best serviced by the interventions of a number of support staff who are familiar with the course content and with the CAL materials and, ideally, are able to make informed judgments about whether any difficulties reported are student based or arise from the equipment or software.

How the achievement of students is measured

Evaluations have used many methods of assessing students. Some of these will continue, especially more use of IT for assessment and automatic marking.

Implications for practice, research and policy

Adult access to learning technologies

The library has found that the information skills packages have the potential to shift the emphasis away from the traditional, passive lecture mode of dealing with large numbers of students to the more distributed, interactive and independent laboratory mode. The packages will be installed on machines in the computer teaching clusters around the campus which will enable library and academic staff to incorporate them into teaching programmes with students having hands-on access. Many of these machines are also available for individual study, so students can work on them in their own time.

The modular structure means that students can select the areas of interest and get useful information even if they only have a few minutes to spare. The packages should also be available soon on the university's local network, Glance. They will be used in future with the Pre-University Summer School, with overseas students English language classes and with faculty-wide postgraduate research training courses. Academic departments will be urged to consider incorporating them into the syllabus for individual subjects, supported by subject related workbooks which are being prepared, and to ensure that students are aware that they are available for individual study. In this way, information skills teaching will reach much larger numbers of students than in the past.

In the case of social science postgraduates, many have varied backgrounds from different courses and a package such as GraphIT! provides a good resource for self-access to fill in the knowledge gaps. Where students are uneasy with technology or numerical data, as some undergraduates on sociology courses can be, we have found it to be an easy and unintimidating introduction to both subject material and computers. In accounting, where there are often large numbers, the package has allowed more time to be spent on teaching aspects of the course which benefit from tutor interaction, leaving the more mechanical background work to CAL laboratory sessions.

The 20th Century Music History class is a large class, made up of a mixture of second, third and fourth year students from different degree courses. Conducting seminars via e.mail avoids timetabling clashes as both students and staff participate at a time which suits them and, as the seminar groups are small with five students in each, all students have ample opportunity to contribute.

Radical changes in the Scottish Higher Music syllabus have meant that not all first year students have experience in some of the basic skills they need for degree work in music. The necessity for a large first year class adds to the difficulties in bringing them up to standard. The Integrated Musicianship package helps to fill the gap without calling on extra staff resources, and enables students to work at their own pace in areas where they need extra help.

One of the main reasons why the CALMAT and TopClass maths packages were selected for first and second year students on the Bachelor of Technological Education degree course was that they can be used to bring up to a common level of achievement the very wide range of mathematical ability. The student intake varies from recent school leavers with standard school leaving qualifications, to many mature learners, some being recruited through access courses or special schemes for disadvantaged population groups. Students have studied a wide variety of maths courses, some recently, some many years ago, and their familiarity with the topics varies a great deal. A diagnostic test is provided to use with CALMAT; originally a paper-based test from Glasgow Caledonian University, and now a second one which is PC-based from Newcastle University. This has been used to specify individually-tailored programmes of study using these maths learning packages.

Infrastructure issues

Any changes should be driven by teaching and learning needs (which include greater efficiency, recruitment retention, etc.), which in themselves are usually driven by external pressures. The key issue to be addressed is how to help planning units, departments and individual teachers evaluate and make decisions on investing in the effective use of IT in delivering learning, and then to support them until they become self-sufficient, during the period when using this technology for learning is a novelty, with sparse local expertise.

Making a decision to adopt new technologies on a large scale is not a trivial one for an organisation. It requires long term survival as the criteria, rather than short-term profitability. The adoption of new technology follows a pattern. Early research identifies something which may be of future benefit, but needs much investment in capital and training, and may even need different or fewer staff. Even before it is certain that the technology must eventually be adopted, some organisations begin to use it. All must decide the timing and size of their investment. Too soon and big -- the costs cripplingly outweigh the short term benefit, and can cause collapse. Too late and slow -- the competitors gain all the business, and again there is collapse. In between there is a difficult judgment. The best strategy is to develop a network of skilled staff aware of the potential of the technology. Decisions on adopting new technologies on a large scale require a commitment to use it initially in a small way, while being ready to move fast to adopt it in a big way. The University of Glasgow is doing this and TILT is placing us in the position of being even more ready. The "big way" is coming much closer as CAL resources appear rapidly from TLTP and elsewhere.

Most of the changes that may be made are incremental and would simply add welcome gains to existing arrangements. Expansion of the use of IT for teaching and learning can follow the success of TILT in demonstrating niches into which it fits well. However, there is potential and perhaps a longer term necessity, to use IT to transform parts of Higher Education more radically by using more flexible, open learning for many more than the traditional full-time locally housed students on degree courses. Institutions should support both of these outcomes, ensuring that they are in a position to move quickly and confidently but leaving individual units to decide if and when they make their changes.

More consideration should be made of the value of working in course teaching teams and working in student learning groups. Evidence of more effective learning is beginning to emerge from the use of CAL in cooperative learning and in a team teaching environment. Productivity improvements flowing from the students' training in IT skills and from the use of computer mediated communication for teaching and assessment are also becoming apparent.

In learning how to incorporate IT into the curriculum in a wide variety of subject areas, TILT has gained valuable experience of working in courseware development teams where there has been close cooperation between teachers and developers. This has resulted in CAL which is specifically designed to meet the needs of particular classes, and, as a by-product, the experience in the formation and effective working of such teams is a skill to be passed on by TILT.

The key messages from TILT

The main messages from TILT are:

- TILT does not advocate radical culture change but assists staff to take advantage of modern technology at a commonsense practical level.

- Creating and using IT for teaching and learning is a complex business -- there is a need to continue to gather and show many examples of good practice, as well as pitfalls, and how to effectively use the staff skills and student study skills packages which are produced.

- The integration of IT into UK HE teaching and learning can be greatly assisted by showing how to apply formative evaluation of the processes. This evaluation assists active learning by all participants in the university (*e.g.* students, teachers, courseware providers, support staff).

- The project has shown how to use, produce, evaluate and adapt learning materials based on Information Technology.

- Staff can be helped to identify, measure and evaluate the costs of and benefits resulting from sets of alternative choices in investing in the application of IT to teaching and learning. TILT can recommend ways of recognising IT solutions which are cost effective and provide value for money. We will promote minimising costs by developing staff skills in providing low-cost software and recycling existing learning packages to suit their own students' needs.

University of Glasgow in TILT National Support Network

TILT has been chosen to be a Regional Centre and participate in a National Network to offer the UK Higher Education sector access to the expertise and experience that the TILT Project has gained over the last three years. The Funding Councils will provide for one member of staff for two years, with the university agreeing to fund two other posts continuing TILT's activities. The Regional Centre will focus on how to integrate IT into teaching and learning, and within the National Network TILT will promote the evaluation and other techniques that have been refined at Glasgow. The Regional Centre will operate in addition to the two CTI centres already at Glasgow that offer advice on subject-specific learning software.

Recommendations

From experience within TILT and in discussion with many others, we make the following detailed recommendations:

IT proponents should:

- show benefits at awareness workshops;

- offer a practical advice support service;

- treat HE staff as fellow learners;

- relate to individual teachers' perceptions;
- recognise and build on an institution's culture.

Courseware providers should:

- choose cross-platform software;
- minimise resource-hungry features;
- design for users' present facilities;
- provide package in small modules from which a teacher selects those needed;
- evaluate packages formatively with classes;
- specify environmental needs of package -- hardware, software, support material;
- specify what the package does, and what the teacher must add;
- provide help and maintenance.

Individual teachers should:

- form local courseware teams;
- join national courseware consortia;
- use national databases;
- make time for training;
- evaluate their teaching.

Departments and cost centres should:

- fund staff to improve their teaching (*e.g.* reduced workloads);
- require rigorous evaluation of expensive innovations;
- treat courseware as publications;
- make internal purchases of institutional support services;
- provide support services for large units.

Institutional management should:

- underwrite or top-slice for support services by experts in:
  - training and assisting in the use of IT in learning
  - training and assisting in evaluation of teaching
  - creating and modifying courseware
  - training in authoring software, and conversion to Internet readability;
- coordinate part-time secondment, on rotation, of teachers to expert service units;
- coordinate formal and informal support networks of enthusiasts for improving teaching;
- show that teaching counts for promotion equally with research and administration;
- coordinate installation of computer networks and adapt accommodation.

Government's role

Government through recommendations to funding and quality assessment bodies could:

- encourage software and hardware standards;
- negotiate national copyright deals;
- underwrite or fund maintenance of successful courseware;
- establish national purchasing deals for learning and authoring software;
- fund national database(s) of learning software and disseminate methods for its effective application;
- train Quality Assessors in evaluation of IT use;
- support R&D to improve learning.

Case study 3 -- Blackburn College

Blackburn College is a major college of Further Education in the North West of England with student numbers of around 25 000 equating to 8 000 full time equivalents. It provides a large range of courses covering areas from A-level to MBA, vocational courses in technology, construction, creative arts, development studies and business and management. It has concentrated on the development of a significant technology infrastructure on its town centre site with a cross college computer network and links to the JANET network as well as providing Internet access and bi-directional links to the local NYNEX cable infrastructure.[5]

In particular the use of the cable network to deliver courses to adults at home is seen as a model for the future in that learning can be provided directly from an educational establishment using a local cable community channel.

Objectives

How and why the goals where chosen

The learning strategy in most Further Education colleges in the United Kingdom is still that of the "teacher/class" scenario in which students attend college on a full or part time basis and take part in classes of instruction supplemented by practical or project work as appropriate. This excludes potential learners who cannot attend conventional classes which are often set in rigid structures. It was recognised that technology could supply the solution to providing some of the "missing mass" of learners with access to education.

The population of learners and how they were selected

The population of potential learners is the growing number of cable television subscribers that live within the NYNEX East Lancashire franchise area. The majority of the 6 000+ subscribers live in Blackburn and Darwen -- the "inner city" areas of the franchise region. Approximately 20 per cent of the population in these towns are of Asian origin and it is accepted that for cultural reasons Asian married women find it difficult to attend courses in the college itself. Also owners of small to medium enterprises have difficulty in finding the time to attend the campus for their educational and training needs because of the pressure exerted by the immediacy of business needs. Although the college has extensive on-campus facilities for disabled students they are seen as likely beneficiaries of distance learning to either replace or support a college based course.

Why a "technology enhanced" approach rather than a "traditional" approach was used

An alternative approach to reaching students unable to come into college would be to exclusively use printed materials. The advantage of using modern technology is to be able to provide immediacy through live or near live broadcasts and to be able to link it with other technologies. Live transmissions can be supported by using telephone conferencing calls to groups of students. Interaction can be provided by dial up modem access to tutorial and peer support by electronic mail and computer conferencing. Occasional drop-in to the college at a time to suit the student can be arranged via the drop-in centres with support on hand and automatic monitoring of student attendance and progression using swipe card technology and computer marked assignments. In the case of the Sign Language Telecourse detailed below a shortage of tutors meant that we were unable to keep up with the demand for the conventionally taught course.

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[5] This case study is derived from material provided by Mr. Len Adam, Assistant Principal, Blackburn College.

Comparison with previous practice

Very little had been carried out at the college in providing for distant learners prior to the introduction of cable TV based education in East Lancashire. The telecourses detailed below were and are available as standard "in-college" courses.

Cost-effectiveness of new approach

The production of cable TV course material is expensive but once the material has been produced it can be reused many times with different sets of students. Naturally it is vital to ensure that the material is up to date and relevant to a changing curriculum but nevertheless material can be restructured without the need for a complete replacement. The aim is to try to make the delivery to students at home as natural as for delivery to students sitting in a classroom. Initial programmes were all produced in the college TV studios which tended to be dominated by media standards but now the move is towards equipping classrooms with camera and display facilities which can link directly into the cable network so that learners at home can join in with the "virtual class" and use a telephone link for interaction. This will have a considerable effect upon the cost of production as it will depend upon existing staff doing what they usually do but who of course will have had additional training in teaching within the virtual environment. Classes will be carried out as normal in the virtual classroom with students physically present who are carrying out the course in college as well as the students who are watching the live class on TV at home or in a local centre.

Curriculum delivered and technology used

Brief description of the curriculum

The following "telecourses" have been carried out using cable TV delivery.

Angrezi Boal Chaal. This telecourse was produced in association with the former Employment Department to attempt to improve the English Language skills of Asian women in the context of the local community. Approximately 100 Asian women were enrolled with 50 per cent watching the programmes at home and 50 per cent watching them in a local community centre. Printed materials were also supplied to support the TV programmes. Local involvement in the production of the programmes was successful including the collaboration of the Police and Health authorities.

RSA Computer Literacy and Information Technology Introductory Certificate. On the first CLAIT Telecourse 12 students at home were provided with laptop computers with hard disk based software corresponding to the course requirements. Students watched the TV programmes that were specially produced for the course. In addition each computer included a modem so that students could communicate with their tutors via electronic mail. Computers were provided to obviate the difficulty of system and software differences. Although this was successful the telecourse could not be extended indefinitely because of the need to supply equipment. An alternative approach was adopted and now students still watch the programmes at home but drop in when they can into the college LEARN Centres to access the computers (LEARN = Learning Education and Research Network). Printed materials are also supplied. Twelve students have just been awarded their certificates following the new approach and the course is being re-advertised.

National Examining Board for Supervisory Management Introductory Certificate. The NEBSM course has run twice via cable TV and is seen as being the basis from which higher level business and management telecourses will develop. It was produced in collaboration with Liege College in Belgium -- the first programme was written in Liege, translated into English and filmed in a local company in Blackburn. Most of the material was obtained from a third party for the TV broadcasts with occasional live sessions from the studio.

Introduction to British Sign Language Telecourse. British Sign Language courses have been available in the college for some time. When it was discovered that students were being turned away in quantity as a result of the shortage of deaf tutors which are an essential requirement it was decided to adopt a new approach using cable TV delivery. The course is quite popular and involves students in watching TV programmes at home or on video supported by the course materials. Students also attend college or a local centre on 3 occasions for tutorials with the deaf tutor which they all enjoy.

Spanish Telecourse. A Spanish Telecourse is in mid production which will be run on similar lines to the CLAIT Telecourse in that students will drop in to the Language Centre to access multimedia language learning materials as well as watching TV programmes at home produced in the college. The college is collaborating with a multimedia language provider who will provide video based material and the Spanish TV presenter.

Software, hardware and other technology used in the classroom and elsewhere

There are three strands to the technology. The first strand is that of the cable TV link itself. The college is linked from its own head end to the NYNEX head end on the Glenfield Park Industrial Estate in Blackburn by 4km of underground fibre. In addition the college receives all cable TV channels by special links in three of the college buildings. Access to the Community Channel is provided by NYNEX at their head end for agreed periods during the day. The second strand is that of the computing and multimedia facility. The main LEARN centre consists of a network of 45 PC computers with full access to the college network. (The network has a huge amount of software available on 38 file servers.) This allows students dropping in to the centre to access "First Class" Computer Conferencing software. This is the essential link between drop in students and their tutor. Tutors can communicate with students without the constraint of time. Plans for the future include establishing country-wide telecourses with material delivery and communications via Internet and World Wide Web pages. The third strand is that of ISDN Video conferencing. Its rapid development will undoubtedly provide a mechanism for widespread tutorial support. In addition to the face-to-face video that it makes possible. Its use in sharing applications or even remote control of a distant computer -- perhaps to put right a software fault on a machine -- will guarantee its place in distance learning. Too expensive at the moment perhaps for home installations but low cost equipment -- easily affordable to the home computer owner -- is coming on to the market. The technology infrastructure at present consists of the computing element, the cable TV element and the ISDN network. Developments in compression techniques will undoubtedly bring these closer together so that eventually high quality two-way video delivery becomes possible via a computer based network into the home. Another facility at Blackburn College -- the Cyber Classroom -- consists of a video conferencing unit linked to a high quality video and data projector that will project full size images of "virtual professors" from around the world onto a screen. A pilot is being carried out on the current MBA course in the college with business experts from around the world taking a class -- as part of the standard course curriculum.

Staff and student attitudes

Staff are generally supportive of the cable developments but still see it as a "project" rather than an integrated method of curriculum delivery. It is not so much a resistance as an inability to manage to "swim to the riverbank" for a look at the possibilities away from the fast flowing river of conventional delivery. Telecourse students are interested in the opportunity for education provided but still need to be convinced that it is valid alternative. It needs a much wider adoption and accompanying publicity to make potential students aware of the possibilities. It is an unknown quantity to most people in the United Kingdom.

Staff training

Staff are currently being offered training in the use of the Virtual Classroom and the Cyber Classroom for distance learning work. A series of courses have been set up and advertised across the college. In addition a number of staff have carried out screen tests as TV presenters in the general sense of introducing programmes as distinct from direct virtual teachers. Training is also being planned for staff across the college to make them aware of the nature of the cable service for students to attempt to eliminate infrastructure problems in the future. As far as the computer technology is concerned a dedicated IT Staff Training facility has been established which not only teaches staff about the technology and software itself but also introduces them to the use of technology, resource and distance based learning.

Level of technological skill needed to participate in the programme

The level of skills needed are minimal in all of the programmes offered. At home students do not have any problems with the use of TV based equipment and video recorders. Some problems did arise with the CLAIT students and their portables which involved some keen staff going to students homes to support them. Since the change to the use of the centres this has been eliminated because of the support that is always provided in these areas.

Roles of instructors and learners in the curriculum and how the use of technology has changed roles

The move to telecourses is involving staff in the production of video and paper based materials to support the new approach. Staff have to gain skills in new areas and deliver the educational product in a completely different way. On-line tutorial support at a distance requires a different approach and precise rules and structures have to be established and followed. A Telecourse Tutor's Handbook is being produced which guides staff in their new roles.

How students achievement is measured

In general, student achievement is measured through conventional techniques. Students on all telecourses are set exercises which they carry out as would an in-college student. Some automated assessment is possible and is used on an IT based RBL course within the college but this has not yet been extended to telecourse students dropping in to the centres. All telecourses at present do include tutorials requiring drop in on two or three occasions to the campus or the visit of the tutor to a remote centre. For example the Sign Language Telecourse was carried out by video delivery to a centre at

British Aerospace for their employees (13 students). The tutor met the students on site for their tutorial work and they used the videos and print based materials in the centres at other times.

Implications for practice, research and policy

Adult access to learning technologies

Blackburn College has concentrated on making access to learning technology for drop-in adult learners enrolled on college courses. The following centres are currently available to them.

Library: The library is a major source of material for Flexible and Resource Based Learning. This includes computer based as well as paper and video based products. CD-ROM databases and catalogue searches can be carried out in the library. Access is from 9.00 to 21.00 all evenings except Friday when it closes at 17.00. A range of materials are held for individual student selection.

The maths and English Workshop: This facility provides support for students who need help with their maths and English work. It is staffed by Academic Staff who provide any help needed by any students in the college. Organised Open Learning to deliver specific courses is shortly to be developed. There are also networked computers in the workshop.

LEARN 1: The LEARN 1 facility is open the same hours as the library. It contains 45 networked PCs and printing facilities. Ten machines are multimedia but there are plans to distribute these around the open access centres. It is clearly used extensively by Business and Management students as a drop in computer access area but last year was also used by other faculties in a major way. It is a base for RBL GFIT with excellent support from the manager and staff. As stated in the strategic plan the aim is to move towards its development as a Personal Learning System base as IBM or other CD-ROM multimedia based developers bring out appropriate products. It is an area in which it would be appropriate for college staff to get involved as we have been asked -- as have all colleges -- to look at specific NVQs that we might wish to develop from what we currently have on paper -- to multimedia format. There is a double benefit: (a) Ownership of the material in terms of staff preferring to tailor their teaching/learning to their own requirements; and (b) potential income from the sales by IBM of the CDs. Students would work as individuals through the computer based packages, be assessed by the system. Progress and results would be passed through to Learning Centre Manager (our software) and via the network to faculty staff monitoring the students. This is an area that needs addressing. Faculty staff will need training to carry out the monitoring. It requires a different way of thinking to accept responsibility for students that you do not teach directly. GFIT experience illustrates that staff can easily assume that everything is being done in the centre including student progress chasing. The basic PLS software has been given to us by IBM for use in the Staff Development Centre and is now available. Courses in its use are being planned. A link exists between this centre and the CLAIT Telecourse. This is carried out by cable students watching the programmes at home and then dropping in, in the evenings to use the facilities. The Distance Learning Manager is scheduling this course.

LEARN 2: The LEARN 2 facility serves students from the faculty of 6th form Studies (16-19 year old learners). It is dual room facility with a booked teaching area acting as an overflow for drop in access by students when not in use. LEARN 2 contains 20 networked Pentiums with printing facilities. The adjacent classroom contains 16 networked pentiums. Activities in LEARN 2 replicate those in LEARN 1. It is envisaged that this centre will also incorporate PLS when it arrives. We will then have two centres in which independent computer based learning can take place forming an increasing component of the curriculum. It is currently open 9am to 5pm.

Apple Multimedia Centre: The Apple Centre is basically a facility for the Faculty of Creative Arts to give students access to the appropriate computer technology for design/printing/media courses used in industries. It contains 16 Macintosh LC11, 16 Macintosh Power PCs with multimedia facilities, three Laser Printers and two flat bed scanners. Software includes MacWrite, MacPaint, Aldus pagemaker, Freehand, Adobe Illustrator, Dimensions, Photoshop, Quark Express, Macromedia Freehand and Director. This allows full multimedia production including video, audio and graphics. It is open every afternoon for drop in students from across the college although it can be available at other times.

Language Centre: The Language Centre is on the LEARN 2 corridor and is quite small, only permitting about a dozen or so students at a time to use it. It is used mainly by taught classes who accompany the teacher to the centre from another room. Students do use it individually to access interactive language learning by IVI and CD-ROM, videos, audio tapes, cable and satellite TV channels, dictionaries and printed materials. Some OL packages are available. It will form the base for the drop in Spanish Telecourse students when this starts later in the session.

Higher Education Study Centre: The Higher Education Study Centre (HESC) occupies most of floor 4 in the Higher Education Centre. There are two areas within the centre which is accessed by a turnstile/swipe system. The first area consists of a drop in computer centre (20 terminals) supported in the same way by Computer Services as the two LEARN centres. The centre allows access to all standard network student software and additional specialist software for HE courses. For example it is now possible for law students to access the LEXIS database by remote dial up via the network. In addition any HE student can access the World Wide Web on Internet from this facility. Additional RBL software is being put onto the network for HE student access. The remainder of the area is a quiet study area (36 places) for HE students. Both areas are already being extensively used.

Infrastructure issues

There are several infrastructure issues that must be addressed to permit the development of applications of new technology. These are:

The attitude of senior management

Senior managers in colleges need to adjust their thinking to be able to cope with new developments in learning technology and delivery mechanisms. It is very easy to carry on from year to year on the assumption that courses and their support infrastructure will remain the same. Without the support of senior managers nothing will change. For example -- will telecourses that are developed centrally be given the same level of support as conventional well established courses? Will material preparation time be credited by the managers as direct teaching? Experience shows not at this stage.

The attitude of academic staff

Many staff see Resource Based and Distance Learning as a threat to their very livelihood. Undoubtedly the current staffing infrastructure will have to change as staff become more involved with production than in direct delivery. Traditionally teaching is counted as "work" for further education teachers and preparation of materials as a spare time activity when not in the classroom. Teachers see the development of reusable materials as a threat and considerable staff development is needed to convince them otherwise. A college with many distant learning students will need a completely different academic staff structure to meet the customers needs.

The administrative infrastructure

There are many implications of new technology for the administrative infrastructure. For example, how will the new learning delivery methods be marketed? At present many colleges recruit by holding open evenings and college visits. How are students enrolled and recruited who cannot get into the establishment? Can full enrolment be carried out by telephone or via Internet? When the distance learning students are recruited a completely new structure for support will be needed. People are getting accustomed to 24-hour service *e.g.* telephone banking. It is not too unreasonable to think that distance learning students will soon expect to be able to call into the college and that a specialist tutor will be there to answer their questions directly without a search around the college for someone who might be able to help. The structure will have to be in place.

Case study 4 -- Halton College

Halton College is a major college of Further Education in the Wirral area of England, offering vocational and general education to young people from 16-19 and to adults of all ages. It is part of the college's strategy to adopt a structured and holistic approach to learning technology. The process of integrating learning technology into all areas of the curriculum is demanding both in terms of investment, curriculum and staff development. Nevertheless, Halton College has achieved a high degree of integration in a number of areas.[6]

College facilities

Halton College offers open access for all students and staff to a large number of learning technology facilities. A central Learning Centre includes the following:

- a Novell network with full multimedia capabilities and Campus 2000 and Internet access;
- a centre for SMEs equipped with Pentium PCs and a Silicon Graphics Computer with Virtual Reality software;
- video conferencing room equipped with ISDN 6 line, visualiser and electronic whiteboard and remote control satellite reception system.

The college's two main sites are equipped with a 6 Mb Microwave link ensuring seamless communication between the two sites.

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[6] This case study is derived from material provided by Dr. Jette Burford, Head of Research and Development, Halton College.

Technology in the community

Video conferencing equipment has been purchased for installation in four local schools and five companies nationwide. A further ten systems will be installed during 1995. In addition, a bank of laptop computers are being used for training in local schools and community centres. Twenty seven computers have been placed in the community to support outreach work for special needs students during the last year.

Objectives

The projects described in this paper are reflections of the college's curriculum vision: "to use technology to transfer the focal point of education and training away from college buildings into a dispersed model, locally, nationally and internationally".

At Halton College we believe that the future will be technological and ever changing. It is therefore imperative and timely to examine curriculum content, the learning methodology and delivery methods. We believe that a "technology enhanced" approach rather than a "traditional" approach is relevant to all of the curriculum. Employees of the future will need to learn throughout their working lives, and coping with technological change will be considered to be a routine task. We therefore need to change the tutor -- student role away from "teaching and being taught" to a new model of "facilitating and learning". Two projects selected from many are described below.

The Fairbairn Fellowship Project (Project timescale: January 1994 -- December 1996)

This project was mounted by Blackburn College to:

- provide alternative access routes to education and training through the use of flexible and modern learning technology, which enables students to learn what they want, when they want, at a pace which suits them, and in a manner which suits them;

- expand the college's resource bank of flexible learning materials in order to provide additional support to existing students which will facilitate increased class size without compromising the quality of the learning experience;

- pilot the use of remote access technology (Cable TV, video conferencing, etc.) in Runcorn in order to facilitate access to learning by previously excluded groups, *e.g.* women at home, single parents, shift workers, etc.

The project has two strands, one concerned with the integration of multimedia into the mainstream provision, the second with widening access to education and training using video conferencing and Cable TV.

Multimedia -- Education goals

Three strategic routes have been successfully employed in order to integrate computer based multimedia into the curriculum:

- materials production by a professional multimedia team;

- large scale project work and materials production by students;

- development of specialist multimedia courses including a BTEC National Diploma in Multimedia.

A very large number of staff and students have been involved in the multimedia activities. As a result, very important authoring and production skills have been developed by both students and staff. In addition, multimedia materials suitable for independent learning in the college and in the community have been produced.

At Halton College we believe that purchase and production of multimedia learning materials will:

- lead to lower unit cost of delivery;

- allow increased student capacity with a fixed staffing level;

- offer new learning styles leading to new students markets;

- result in greater customer satisfaction.

The initial investment in technology and computer based learning materials is often high and it is very difficult to perform a meaningful cost/benefit analysis during the early stages of the developments. We have, therefore, not as yet been able to demonstrate a lower unit cost of delivery. However we have already seen evidence of the other benefits listed above.

The multimedia materials production by students is of particular interest. The Curriculum Management Team decided in November 1994 that all students on "substantial programmes" should be given the opportunity to produce a small multimedia package about the subject that they study together with their subject tutor. The reason for the decision lies in the belief that authoring and multimedia production skills should be viewed as part of the general communications and information processing skills which all employees of the future will need.

Curriculum and technology

All curriculum areas are included in this initiative. Only a few groups of students are excluded due to specific circumstances. More than 300 students participated in the project during spring 1995.

The activities were carried out in the college's Learning Centre on a PC multimedia network, including printer, scanners, CD-ROM tower, CD-ROM writer, etc. The software used is a simple and affordable authoring package called Masterclass.

A formal evaluation process showed very positive results. The students enjoyed the project and stated that too little time had been allocated for the activities. The lecturers identified several benefits for their students including:

- increased motivation and ambitions;

- improved presentation and communication skills;

- raised awareness of computer applications;
- a fun introduction to IT.

The Research and Development Team at Halton College was given the task of co-ordinating the activities. The tutors were offered staff development in multimedia awareness, general IT skills, authoring and production skills, prior to the student production activities. However, a member of staff from Research and Development supported the tutors throughout the planning and production period.

The level of technological skills required to produce multimedia is still quite high. Therefore the staff development offered prior to the events was not sufficient and most lecturers were learning alongside their students, an experience that some lecturers found "uncomfortable" at first but most accepted as valid towards the end of the production period.

The student achievement is measured in different ways. The lecturers decide how the work should be assessed. Some lecturers were able to relate the activities very closely to the syllabus and had the multimedia package assessed as an assignment. Others assessed core skills only. The evaluation revealed that the lecturers who tied the activities closely to the syllabus had the best response from the students. In addition, the college has achieved accreditation from Merseyside Open College for the activities. Students and staff can now receive a certificate for their participation.

Video conferencing and Cable TV

The target group for the Cable TV and video conferencing pilot scheme, single parents in the Runcorn area, was chosen following extensive market research as described below:

- Stage one, aiming to identify, quantify and locate target groups of excluded learners

  Four target groups were researched: single parents, shift workers, persons caring for a relative in the home and voluntary/community groups. The methods used were mainly desk research and telephone surveys.

  On completion of stage one, the Project Steering Group decided that single parents should be the target group for the pilot scheme. There are over 7 000 single parents in the Halton area, of whom almost half receive family income support. The child care facilities are very limited and carry a high cost. The research showed a high concentration of disadvantaged, single parents within the Cable TV network area.

- Stage two, aiming to identify the needs of the chosen target group

  The Electoral Roll was used to supply actual names and addresses of single parents within the Cable TV network area. Postal questionnaires and focus groups helped us to determine the particular needs of the target group. We established that of those who responded:

  - 83 per cent are interested in education via Cable TV at home;
  - more than 80 per cent have children below 15 years of age;
  - the main activity of more than 60 per cent is to look after children and home;

- 28 per cent have no qualifications.

The identified educational needs were mainly in the following areas:

- computers (59 per cent);
- basic English (45 per cent);
- basic maths (40 per cent);
- job finding skills (36 per cent);
- business studies (32 per cent).

The access to education and training is entirely dependent on a technology approach for this particular group of learners. The initiative represents a completely new approach, opening up education to a group of learners who have no other means of accessing education and training.

The project is built upon a partnership arrangement with the local Cable TV company NYNEX. Free usage of the Cable TV channel ensures that the programmes, once the initial investment is made, can be cost effective. An initial investment in equipment to set up an adequate Cable TV Studio has been necessary.

Due to a delay in laying the cable network in Runcorn, video conferencing equipment has been installed in a local school and used to deliver part of the project. The video conferencing approach is more costly to run, but the initial investment is much lower.

The pilot project is concentrating on basic English, but later this autumn and winter we will offer IT, business studies and languages as well. The following hardware and software is used for the video conferencing course:

- PCs with Pictureted video conferencing equipment *i.e.* camera, video conferencing board, handset and video conferencing software;
- electronic whiteboard;
- Elmo Visualiser;
- ISDN 2 line.

The following hardware will be used for the Cable TV course: Cable TV studio with camera, vision mixer, sound mixer, lighting, genlock, multimedia PC, microphones, talkback system, VCR etc.

The equipment needed in the homes include a TV, VCR and a special telephone allowing the student to dial directly into the studio using a single digit. The research showed that the majority of the target group already possess a TV and VCR. The telephones will be provided free of charge by NYNEX.

The market research carried out amongst the chosen target group, single parents in the Runcorn area, shows a very high level of interest. Over 20 per cent responded to the postal questionnaire and 83 per cent of those expressed a keen interest in using the Cable TV to access training and education.

The interest among the women who participate in the video conferencing course at the moment is very high. Formal evaluation will not be carried out until a later stage; however the informal feedback is very positive indeed.

The staff involved with the project have been selected because of their positive attitude to new technology. As the project offers training to groups of learners who did not have access before there seems to be no resistance from general college staff. We have, however, detected some resistance from a small number of staff in using Cable TV for "in-company training". Some staff perceive the Cable TV approach as competition to the traditional training that the college offers.

The fear is rooted in the potential cost savings that Cable TV offers, as well as the change in the tutor's role. The Cable TV model would allow one tutor to reach many students simultaneously. The video conferencing, however, is viewed in a positive light as allowing support to students in the workplace. Maybe this is because the tutor's role and the tutor/student ratio would not change significantly. The college is currently developing and employing strategies to help the lecturers to overcome their fear of new and more cost-effective learning strategies.

An extensive staff development programme has been carried out. Most of the training has taken place in the college delivered by the Research and Development Team and Learning Support Staff. During the last year more than one hundred staff have received training in using the video conferencing equipment.

However, it is necessary to provide training in "Interactive Instruction via video conferencing". Issues relating to preparation and presentation of "video conferencing tutorials", lesson planning, learning styles, class management and student interactivity must be addressed and included in the training. Halton College therefore sent a lecturer to participate in a two-day practical workshop delivered by "The Open University" in Herleen, Holland. A series of internal staff development sessions will follow, allowing the knowledge and skills to be cascaded throughout the organisation.

It is also necessary to provide training for our lecturers in "how to present in front of a camera". Training in this area has been organised through the University of Central Lancashire.

The students who participate in the video conferencing scheme need a thorough introduction to the technology in a safe environment. Basic keyboarding skills and confidence to operate the video conferencing software are needed for effective usage of the equipment. Initially none of the students on the course have the skills necessary and we provide technical support on site for the video conferencing course. It is anticipated that the students themselves will be able to use the equipment independently, using a normal telephone to call for technical assistance if necessary.

The students who will participate in the Cable TV pilot will not need specific technological skills. However, it is anticipated that some fear of communicating with the tutor and fellow students over the Cable TV network will be a barrier for participation. It will therefore be necessary to allow the students to experiment and become familiar with the technology in a "safe environment".

There is general agreement amongst practitioners that self-study courses convert more easily to video conferencing and interactive Cable TV than didactic courses. Video conferencing puts a natural focus on the students managing their own learning and actively seeking support from the tutor through the medium.

All courses can be taught via video conferencing and interactive TV but the teacher centred courses often require a higher level of skill from the tutor and sometimes substantial curriculum changes are necessary too.

To some extent the tutors will become facilitators of learning and the students must "learn to learn" rather than "being taught". The tutors will also be required to pay attention to an expectation of entertainment that the medium encourages. Although the medium does not require "television stars", tutors should pay attention to visual presentation techniques and tools that might help them to introduce "an element of delight" to the learning process.

Some customer groups in further education have low confidence and need much extra support in their learning process. Our market research for the Cable TV project clearly shows the importance of the social aspects of joining a course. The support systems and social activities which should be provided alongside "technology teaching" in the community must take this into account. The role of the tutor using video conferencing or interactive Cable TV will include the planning and management of such support systems. The importance of these activities must rank as high as the planning and management of the delivery of the course content in order to maintain a high retention rate.

The students' achievements are measured traditionally in terms of progress towards a qualification aim. In view of a technological future where employees will be subject to an ever changing working environment, it is timely to review how we assess our students and what we assess. A greater emphasis on assessing transferable skills, information processing, communication and technological skills such as "network or technology literacy" will be appropriate.

Extensive evaluation of the project will take place towards the end of 1996.

Basic skills provision via multimedia (Project timescale: April 1994 -- April 1995)

This project is funded by the national Basic Skills Agency as a Local Development Project. The project objectives included:

- to translate existing materials into multimedia packages in order to enhance learning opportunities for Basic Skills students;
- to increase the variety of Basic Skills support and opportunities for accreditation available to students on vocational or occupational related courses through the usage of flexible and modern learning technology;
- to use multimedia technology to build on and extend existing provision in partnership with local libraries, community centres, selected companies and Halton schools currently involved in Cheshire's Family Literacy project;
- to monitor and evaluate the effectiveness of the delivery of basic skills through the use of multimedia packages, and measure the quality of the students' learning experiences, using the Basic Skills Agency Quality Mark.

Educational goals

Prior to this multimedia project Halton College developed and piloted a paper based flexible learning package on Study Skills. The package was used by all full-time and many part-time students during their induction and throughout the college year. The very positive feedback from staff and students using the paper based version inspired the Basic Skills Unit to look at new ways of making the package even more attractive and easily available to as many existing and potential students as possible. In line with the college's Curriculum Vision the project team decided to re-design the package for a computer based multimedia environment.

The project was aimed both at the general college population and at existing and potential Basic Skills students in the local community. The underpinning nature of the subject made it possible to target such a large and varied learner group.

The technology approach is superior to the traditional approach for a number of reasons, including:

- multimedia offers a multi-sensory approach which will greatly enhance the quality of the learning process, especially when applied to the subject of "learning to learn";
- the usage of voice-over greatly benefits students who are in the process of improving their reading skills;
- the highly interactive nature of the multimedia packages attracts and maintains students' interest.

The technology approach did require an initial investment in hardware, software, staff development and production time. As the college continuously invests in the newest technology the cost of the hardware and software was covered by central technology budgets. Once the multimedia packages were completed the college incurred no additional cost related to making it available to a large number of students, unlike the approach of using paper based materials which resulted in large photocopying bills every year. Basic Skills tutoring is very staff intensive, and the high costs of delivering such programmes are often reduced through the use of volunteers to assist with the teaching. Multimedia packages and video conferencing tutorials represent an alternative model which gives the Basic Skills customer "access to the best qualified tutor" for longer periods of time.

Curriculum and technology

The multimedia packages covered the following subject areas:

- learning to learn;
- using the library;
- skimming and scanning;
- making notes;
- writing projects and essays;

- revising for and coping with examinations;
- reading and thinking skills.

The packages were made available in the Learning Centre on the multimedia network and used there mainly by mainstream students. Multimedia computers were purchased and placed at the college's Basic Skills Unit, in a local company, a library and in a school. In addition, portable multimedia computers were used in a variety of outreach centres for recruitment of new students and delivery of Basic Skills training. The sophisticated authoring software on which the packages are produced is called "TX-Authoring".

Reactions from both staff and students have been overwhelming. The packages were evaluated by 447 students. In spite of technological teething problems 93 per cent of the students declared themselves to be "very satisfied" or "satisfied". Over 90 per cent of the students who helped with the evaluation had never used multimedia computers before and expected difficulties in accessing the packs. The vast majority of the users, however, found the packs to be very user-friendly. The only slight difficulty was encountered by some of the older students in manipulating the mouse (a touch screen approach is probably more appropriate for certain user groups). Very nearly 100 per cent of the students answered positively to the question: "Would you like more opportunity to learn with multimedia?".

Two groups of students were asked to evaluate the packs and compare them with the paper based version. Below is a selection of comments made by the students highlighting issues and main benefits:

> "I thought the programme was much better on the computer opposed to written down on paper, as the voice over, use of colour and pictures made the programme interesting and informative. I feel if I was given the programme in written format, I would read it quickly and not pick it up again because it doesn't look interesting" (16-20 age group).
> "Better than using books as it is appealing to not just the visual senses but you can also hear the information so it makes you think about the information given" (16/20 age group).
> "People learn more on the computer, as they are learning on a 1-1 basis and not having to speak in front of a group of people if they have learning difficulties. They are challenging themselves, and help is there if needed" (16-20 age group).
> "It's like after being blind. You can use your mind's eye" (51-60 age group).
> "Very nice -- but I want to take part in an actual discussion as well. The computer only answers the questions it is programmed to answer. You can't talk to a machine" (41-50 age group).

The staff have been extremely positive as well, although it is clear that technophobic teaching staff need much support and staff development. It is imperative that the multimedia computers are reliable and that technical support is available when needed. The equipment must be installed where it is easily accessible. Students and staff are not motivated to use inaccessible multimedia, no matter how wonderful it is.

The role of the Basic Skills tutor has changed towards facilitating the learning rather than being at the centre of it. In addition to supply subject specific and general support, the tutor must now support the student in gaining confidence in using the technology.

An individual learning plan is created through negotiation with the individual student and progress is measured against the plan, which is re-negotiated as necessary. The student's ability is tested both by computer aided testing and by traditional methods.

The multimedia packages are now being used in conjunction with video conferencing tutorials and face to face workshops. The combination of the different learning styles seems very successful. We still need to research and understand which combinations and proportions of learning methods are most effective for the different learner groups.

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ADULT LEARNING AND TECHNOLOGY IN OECD COUNTRIES

In all OECD countries, educational policy makers face two new challenges: the growing importance of lifelong learning and the rapid development of new technologies. However, adult learning has been on the margins of educational policy debate in most countries for many years, and "technology" has been seen as an interesting enhancement to the mainstream, rather than something which fundamentally changes educational institutions and our understanding of learning itself.

How serious are these challenges? How much are the technologies already changing post-school learning? How much and how might they extend or limit access to learning for those who have benefited least from education in the past and who now increasingly risk social and labour market exclusion? Are we sufficiently attentive to the human dimensions of technological change? Above all, what issues must policy-makers consider, which can they influence, and what evidence do they need to make decisions?

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